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# **REPORT.DOCUMENTATION** PAGE

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#### 1. INTRODUCTION

During June, 1992, through December, 1993, the John A. Volpe National Transportation Systems Center (Wolpe Center), in support of the Federal Aviation Administration, Office of Environment and Energy, developed Version 4.11 of the Integrated Noise Model (INM). The User's Guide for the Version 4.11 computer software, prepared by the Volpe Center's Acoustics Facility, is a supplement to the Integrated Noise Model ((INM),, Version 3, User's Guide - Revision 11 for the Version 3.10 computer software released in June, 1992. Section 1.0 of the supplementary document presents computer system requirements and installation procedures for INM Version 4.11.. Section 2.0 describes the user's implementation of several new capabilities, including descriptive examples. Appendix Adescribes the technical revisions made to several internal algorithms primarily revisions which are transparent to INM users. Appendices B and  $\mathbf{C}_{\prime\prime}$  respectively, present a technical discussion of two new capabilities, the takeoff profile generator and the capability to account for airplane runup operations. Appendix D presents a copy of the INM Input Testcase, revised to reflect INM Version 4.11 enhancements. Appendix E contains a copy of the User's Manual for the WINM computer software, an INM Version 4.11 plotting program for use with Microsoft Windows.

### 1.1 Computer System Requirements

INM Version 4.11 operates on an IBM Personal Computer
(PC) -Compatible platform with the following minimum
configuration:

- IBM PC-AT or compatible, Series 286 microprocessor;
- 3 MB of available hard disk space;
- 590 KB of Random Access Memory (RAM) or 3 MB of RAM, if operating the INM from a RAM disk, as discussed in Section 1.2.1 below;
- Math co-processor, Series 80287; and
- Microsoft-compatible Disk Operating System (MSDOS)
   Version 3.3.

In addition, the **CONFIG.SYS** file on the PC slated for **INM** Version **4.11** installation must contain the following lines: **BUFFERS=300**; and **FILES=300**.

### 1.2 Installation

The files on the INM Version 4.11 system diskette have been stored in a compressed format using the PKZIP Version 1.1 utility software [Copyright (c)) 1990 PKWare, Inc.]. With the source drive prompt displayed on the screen, execute the UNPACK batch file to install INM Version 4.11 on your PC:

#### • UNPACK <SOURCE DRIVE> <TARGET DRIVE>

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This will assign the RAM drive, i.e., the D-drive, to operate within the subdirectory C:\RAM on the hard drive. Note: It is extremely important to remember that each time the PC is reset or its power is turned off, the information stored on the RAM drive will be lost. As a result, if the INM is run from the RAM drive, all files must be copied to a physical drive, e.g., a floppy drive, prior to powering-off the PC.

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### 2. IMPLEMENTATION OF INM VERSION 4.11 ENHANCEMENTS

the document describes the methodology for Section of implementing INM Version 4.11 enhancements. Ιt includes a background discussion of the enhancements, a brief discussion of the need for the enhancements, and example implementation of the enhancements. The following enhancements are discussed: takeoff profile generator; (2) the ability to account for terrain elevation around a specified airport; (3) the ability to compute the CNEL, WECPNL, LEODAY, and LEONIGHT noise metrics; (4) the ability to account for airplane **runup** operations; (5) the ability to account for runway thresholds during approach operations; (6) an enhancement to the noise contour computations; (7) an increase in the number of takeoff profile segments; and (8) enhancements to the echo file.

### 2.1 Takeoff Profile Generator

This enhancement allows for the computation of airplane takeoff profiles based on the user-supplied airport elevation and temperature entry in the SETUP section of the INM input file. The takeoff profiles are utilized by the INM in the computation of all noise metrics. Previous versions of the INM utilize takeoff profiles which were based on standard-day conditions, i.e., temperature of 590F and airport elevation of zero ft Above Mean Sea Level (MSL). Previously, the user-supplied airport elevation (altitude) and temperature were only used to compute an atmospheric acoustic impedance correction.

The takeoff profile generator is made possible by inclusion of standardized airplane operating procedures and performance coefficients in Data Base Number 11.. procedures and coefficients are presented in References  $2_{u}$   $3_{u}$ and 4, and accessible from the Data Base using the ACDB11.EXE computer program, supplied with the Version 4.11 release. With the exception of INM airplane numbers 1, 6, 7, 8, 10, 24, 56, 100, 101, and four of the new airplanes (INM airplane numbers 104 to 107)) discussed further in Appendix A, the operating procedures and performance coefficients required for takeoff profile computation are included in Data Base Number For the airplanes without standard procedures and coefficients the takeoff profile for standard conditions is assumed regardless of the airport elevation and temperature. Note: The incorporation of the takeoff profile generator will not affect the standard approach profiles. The approach profiles are the same as employed in INM Version 3.10..

Operation of the profile generator is time-efficient and entirely transparent to the user. If other than standard-day conditions are specified by the user in the SETUP portion of the input file, the profile generator automatically computes the takeoff profiles using the airplane performance coefficients in Data Base Number 11 and the equations in the

Society of Automotive Engineers Aerospace Information Report 18455 ((SAE/AIR 1845). When an airport elevation and temperature is not specified, the INM assumes standard conditions and utilizes the standard profiles included with Data Base Number 11, i.e., the internal profile generator will not be exercised.

To insure the takeoff profiles and resultant noise metrics computed by **INM** Version 4 .11 are reasonable for the **user**-defined input case, a runway length check has been instituted. When the computed ground roll segment of the takeoff profile exceeds the user-specified runway length, the user is notified of the discrepancy. A message similar to the following is included in the echo file.

WARNING: COMPUTED GROUND ROLL ERROR FOR INM AIRPLANE 747200,, STAGE WEIGHT 7, -- EXCEEDS USER-DEFINED RUNWAY LENGTH BY X PERCENT FOR THE TAKEOFF ON TRACK TR1, RUNWAY 09L..

In many cases this warning will indicate to the user that there is an error in the input file, possibly in the **user-**defined average yearly temperature, airport elevation, airport runway length, or airplane stage weight. In cases where the computed ground roll segment exceeds the runway length by more than 10 percent, the above message will be included in the echo file as a fatal error rather than a warning and the user will not be permitted to continue processing of the input case.

There may be instances where the user has correctly defined the input case and the computed ground roll segment exceeds the runway length by more than 10 percent. This apparent anomaly may be the result of using the average yearly temperature at the airport as an input. For example, a particular airport may be capable of operating a high stageweight B747 airplane in the early evening or during winter months only, when the temperature is significantly lower than the average yearly temperature. In such cases it is suggested that a user-defined profile be included in the input file.

In addition, there may be instances (e.g., high stage weights, high temperatures, and high airport elevations combined) where a negative rate-of-climb is computed. Consequently, a fatal error will occur and a profile will not be generated. In such instances, the user will be notified with a message similar to that below; it is suggested that a user-defined profile be included in the input file.

• FATAL:: PROFILE FOR INM AIRPLANE 7472000, STAGE WEIGHT 7 CANNOT BE COMPUTED.

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WARNING: COMPUTED GROUND ROLL ERROR FOR INM AIRPLANE 747200,, STAGE WEIGHT 7, -- EXCEEDS USER-DEFINED RUNWAY LENGTH BY X PERCENT FOR THE TAKEOFF ON TRACK TR1, RUNWAY 09L..

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• FATAL:: PROFILE FOR INM AIRPLANE 7472000, STAGE WEIGHT 7 CANNOT BE COMPUTED.

longitude of a reference point at the airport (e.g., the beginning of the primary runway). In the following example the latitude and longitude are for the start of Runway **09L** at Boston-Logan.

- ENTER 3 LETTER AIRPORT IDENTIFIER (EX. BOS):: BOS
- ENTER RUNWAY LAT COORD. DEGS MINS SECS (EX. 42 21 20):: 42 21 20
- ENTER RUNWAY LON COORD. DEGS MIMS SECS (EX. 71 00 48): 71 00 48

The MAKEFILE.EXE program then computes the coordinates of the southeast corner of a one-degree by one-degree data-block based upon the start of the airport's primary runway being at the geographic center of the block. The computed southeast corner is displayed along with the four RMC DEM files required to construct the one-degree by one-degree data-block around the airport. The user is also given the option to overwrite an existing or create a new BOS.3CD file, where BOS is the three-letter airport identifier.

- THE SE CORNER OF THE REQUIRED (1X1 DEG) DATA BLOCK IS: 41 52 70 31
- THE REQUIRED DEM FILES ARE:: NW FN=42071.3CD NE FN=42070.3CD SW FN=41071.3CD SE FN=41070.3CD
- DO YOU WISH TO CREATE A NEW BOS.3CD FILE (Y/M) ? Y

The user should type \(\frac{\mathbf{X}}{\mathbf{L}}\) to overwrite/create a new file. If the four DEM files exist in the current directory, the program will create the BOS.3CD file without further prompting. If MAKEFILE.EXE cannot find the required DEM files, it will request that the user enter the drive where the DEM files are resident. In addition, MAKEFILE.EXE will ask if the data are on the RMC CD-ROM and, if so, copy them into the current directory. If the four DEM files are not on the CD-ROM drive, MAKEFILE.EXE will request the path where the files can be found. The program will then construct the required One-degree by one-degree data-file, with the airport's primary runway at its approximate geographic center. The user will be informed that the file has been constructed, and the minimum and maximum elevation within the constructed one-degree by one-degree block will be provided.

#### • WRITING OF BOS. 3CD IS COMPLETE

The example BOS.3CD file is now ready for implementation by the INM. To utilize the elevation data in the BOS.3CD file in the computation of source-to-receiver slant range, the user must specify, in the SETUP portion of the INM input file: (1)

the three-letter airport code which identifies the specific user pre-processed .3CD file; (2) the disk-drive location of the .3CD file (Note: It is not necessary to specify the location of the .3CD file if it is in the current directory; also, if the .3CD file resides in a subdirectory, the path to that subdirectory must be created prior to running INM.); and (3) the latitude and longitude of a user-defined reference point at the airport, where the X and Y coordinates of all defined runways must be referenced to this point. To insure that the user has identified the appropriate .3CD file, the INPUT.EXE program will test the user-defined reference point at the airport against the stored reference in the .3CD file.

In the following example the user has: (1) specified Boston's Logan International Airport; (2) identified the C-drive as the location for the BOS.3CD file; and (3) specified the latitude and longitude of a reference point at Boston-Logan.

#### ● SETUP::

TITLE < EXAMPLE IMPLEMENTATION OF BLEVATION ENHANCEMENT>
AIRPORT < BLEVATION EXAMPLE>

CODE BOS
DRIVE C
LATITUDE 42 21 20
LONGITUDE 71 00 48

With the elevation enhancement invoked as described above, all noise-level computations are performed based upon the actual source-to-receiver slant range, rather than assuming a flat terrain as was the case in previous versions of the **INM**.

In addition, the data in the BOS.3CD file are used to compute the slope of a three-by-three arc-second tangential ground plane, with the receiver at its physical center. This ground plane is used in the computation of the source-to-receiver elevation-angle, beta, required by the lateral attenuation algorithm in the INM. The beta angle is defined as the angle subtended by the propagation path from the airplane to the receiver and the three-by-three arc-second ground plane. Figures 2-1 and 2-2, respectively, depict the beta angle for two scenarios: (1) previous versions of the INM (i.e., flat terrain); and (2) INM Version 4.11..

# 2.3 CNEL, WECHNI, LEQUAY, and LEQNIGHT Noise Metrics

The capability to compute four additional noise metrics has been included in INM Version 4.11. They are the Community Noise Equivalent Level ((CNEL)), Weighted Equivalent Continuous Perceived Noise Level ((WECPNL)), Equivalent Sound Level During Daytime Hours ((LEQDAY)), and Equivalent Sound Level During Nighttime Hours ((LEQNICHI)). The addition of these four metrics brings the total number of metrics available for computation by the INM to eight ((NEF), LEQ, LDN), TA, CNEL, WECCPNL, LEQDAY, and LEQNICHI). As was the case in previous

the three-letter airport code which identifies the specific user pre-processed .3CD file; (2) the disk-drive location of the .3CD file (Note: It is not necessary to specify the location of the .3CD file if it is in the current directory; also, if the .3CD file resides in a subdirectory, the path to that subdirectory must be created prior to running INM.); and (3) the latitude and longitude of a user-defined reference point at the airport, where the X and Y coordinates of all defined runways must be referenced to this point. To insure that the user has identified the appropriate .3CD file, the INPUT.EXE program will test the user-defined reference point at the airport against the stored reference in the .3CD file.

In the following example the user has: (1) specified Boston's Logan International Airport; (2) identified the C-drive as the location for the BOS.3CD file; and (3) specified the latitude and longitude of a reference point at Boston-Logan.

#### ● SETUP::

TITLE < EXAMPLE IMPLEMENTATION OF BLEVATION ENHANCEMENT>
AIRPORT < BLEVATION EXAMPLE>

CODE BOS
DRIVE C
LATITUDE 42 21 20
LONGITUDE 71 00 48

With the elevation enhancement invoked as described above, all noise-level computations are performed based upon the actual source-to-receiver slant range, rather than assuming a flat terrain as was the case in previous versions of the **INM**.

In addition, the data in the BOS.3CD file are used to compute the slope of a three-by-three arc-second tangential ground plane, with the receiver at its physical center. This ground plane is used in the computation of the source-to-receiver elevation-angle, beta, required by the lateral attenuation algorithm in the INM. The beta angle is defined as the angle subtended by the propagation path from the airplane to the receiver and the three-by-three arc-second ground plane. Figures 2-1 and 2-2, respectively, depict the beta angle for two scenarios: (1) previous versions of the INM (i.e., flat terrain); and (2) INM Version 4.11..

# 2.3 CNEL, WECHNI, LEQUAY, and LEQNIGHT Noise Metrics

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versions of the INM, Version 4.11 allows for the computation of all metrics simultaneously in grid mode or a single user-defined metric in contour mode for a given input case. A brief description of the CNEL, WECPNL, LEQDAY, and LEQNICHT noise metrics follows:

(1) Community Noise Equivalent Level (CNEL): The CNEL noise metric, which is primarily used in California, is similar to the Day-Night Sound Level (LDN) metric in that it incorporates the energy-averaged A-weighted sound level integrated over a 24-hour period. However, unlike LDN, CNEL incorporates an additional penalty for operations occurring between the evening hours of 1900 and 2200 hours. For CNEL, a 3 dB penalty is applied to operations occurring between 1900 and 2200 hours, and a 10 dB penalty is applied to operations occurring between 2200 and 0700 hours. The equation for computing CNEL within the INM is as follows:

CNEL = SEL +  $101\log_{10}(N_{\text{day}} + 3N_{\text{eve}} + 100N_{\text{inght}}) - 49.4,$ 

where **SEL** = Sound Exposure Level in **dBA**;

N<sub>day</sub> = number of operations between 0700 and 1900 hours local time;

N<sub>eve</sub> = number of operations between 1900 and 2200 hours local time;

 $N_{\text{night}}$  = number of operations between 2200 and 0700 hours local time;

and 49.4 = constant which normalizes CNEL to a 24-hour period, (i.e.,  $10\log_{10}((1/86,400 \text{ sec/day})) = -49.4)$ ..

(2) Weighted Equivalent Continuous Perceived Noise Level (WECPNL): The WECPNL noise metric, which is primarily used by the European Community, is based upon the PNLT noise metric and is computed within the INM as follows:

WECPNL = EPNL +  $101\log g_1 (N_{3y} + 3N_{eve} + 100N_{13ph})$  - 39.4,

where all definitions are the same as in CNEL, above, except:

EPNL = Effective Perceived Moisse Level in dB; and

39.4 = (49.4 - 10); where 49.4 is the constant which normalizes WECPNL to a 24-hour period,

(i.e.,  $1010g_{10}$ , (11/86,400) sets/day) = -49.4); and -10 is the duration normalizing factor in the definition of **EPNL**.

(3) Equivalent Sound Level During Daytime Hours (LEODAY):
The LEQDAY noise metric is an energy summation of the aggregate environment, as measured in A-weighted decibel units ((dBA)) normalized to the 15-hour time period from 0700 to 2200. The equation for computing LEQDAY within the INM is as follows:

LEQDAY = SEL +  $10\log g_1(May + N_{eve}) - 47.3$ ,

where all definitions are the same as in **CNEL**, above, except:

- 47.3 = constant which normalizes LEQDAY to the 15-hour period from 0700 to 2200, (i.e.,  $1010g_{10}$  (1/54,000 sec) = -47.3)..
- (4) Equivalent Sound Level Buring Nighttime Hours (LEONIGHT):
  The LEONIGHT noise metric is an energy summation of the aggregate environment, as measured in A-weighted decibel units (dBA) normalized to the 9-hour time period from 2200 to 0700. The equation for computing LEONIGHT within the INM is as follows:

LEQNIGHT = SEL +  $10llog_a(MM_{High})$  - 45.1,

where all definitions are the same as in **CNEL**, above, except:

45.1 = constant which normalizes LEQNIGHT to the 9-hour period from 2200 to 0700, (i.e.,  $10\log_{10}(1/32,400 \text{ sec}) = -45.1$ ).

### 2.4 Airplane Runup Operations

This enhancement allows **INM** Version **4.11** to compute noise levels due to airplane engine **runup** operations. The need for this particular enhancement is recognized primarily around airplane maintenance facilities. To invoke this capability the user must define an airplane **runup** in the TAKEOFF section of the input file as follows:

int.mm.

Takeoffs by frequency:

TRACK RU1 RWY 09L STRAIGHT 50

OPERATION 747200 RUNUP 1 D=30

OPERATION 747200 STAGE 4 D=80

COR>
OPERATION 747200 STAGE 4 D=80 RUNUP 1 D=30

(i.e.,  $1010g_{10}$ , (11/86,400) sets/day) = -49.4); and -10 is the duration normalizing factor in the definition of **EPNL**.

(3) Equivalent Sound Level During Daytime Hours (LEODAY):
The LEQDAY noise metric is an energy summation of the aggregate environment, as measured in A-weighted decibel units ((dBA)) normalized to the 15-hour time period from 0700 to 2200. The equation for computing LEQDAY within the INM is as follows:

LEQDAY = SEL +  $10\log g_1(May + N_{eve}) - 47.3$ ,

where all definitions are the same as in **CNEL**, above, except:

- 47.3 = constant which normalizes LEQDAY to the 15-hour period from 0700 to 2200, (i.e.,  $1010g_{10}$  (1/54,000 sec) = -47.3)..
- (4) Equivalent Sound Level Buring Nighttime Hours (LEONIGHT):
  The LEONIGHT noise metric is an energy summation of the aggregate environment, as measured in A-weighted decibel units (dBA) normalized to the 9-hour time period from 2200 to 0700. The equation for computing LEONIGHT within the INM is as follows:

LEQNIGHT = SEL +  $10llog_a(MM_{High})$  - 45.1,

where all definitions are the same as in **CNEL**, above, except:

45.1 = constant which normalizes LEQNIGHT to the 9-hour period from 2200 to 0700, (i.e.,  $10\log_{10}(1/32,400 \text{ sec}) = -45.1$ ).

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int.mm.

Takeoffs by frequency:

TRACK RU1 RWY 09L STRAIGHT 50

OPERATION 747200 RUNUP 1 D=30

OPERATION 747200 STAGE 4 D=80

COR>
OPERATION 747200 STAGE 4 D=80 RUNUP 1 D=30

In addition, the specific location, e.g., the start of a runway or at a maintenance facility, and heading of the **runup** operation in the above user-defined example must be specified in the RUNWAYS section of the input file as discussed earlier in this section. A technical discussion of the airplane engine **runup** capability is presented in Appendix **C.** 

#### 2.5 Approach Runway Thresholds

The capability to account for displaced runway thresholds for approach operations has been added to INM Version 4.11.. In previous versions of the INM, the runway touch-down point was assumed to be a fixed **954 ft** from the edge of the runway for airplanes with a three degree approach glide slope, and 572 ft for the four airplanes with a five degree approach glide slope With **INM** Version **4.11**, a ((INM airplane numbers 74 to 77). user-defined displaced threshold (DT), either positive or negative, is added to the fixed runway touch-down point. To they are insure realistic DT's are defined by the user, checked versus the runway coordinates. If discrepancies exist, the user is notified in the echo file, as appropriate. In the following example, a 1454 ft runway touch-down point has been defined in the SETUP section of the input file for Runway 09L (i.e., 500 ft for the user-defined DT plus 954 ft for the fixed touch-down point); and a runway touch-down point of 954 ft has been defined for Runway 27R:

## • SETWP::

TITLE <EXAMPLE IMPLEMENTATION OF APPROACH RUNWAY THRESHOLD>
AIRPORT <RUNWAY THRESHOLD EXAMPLE>

ALTITUDE 23 TEMPERATURE 12.66 C

#### RUNWAYS

The above runway definition is depicted graphically below:

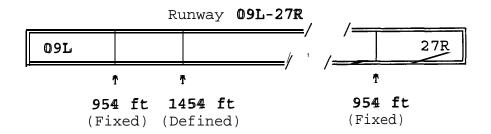


FIGURE 2-3:: RUNWAY DEFINITION

In addition, the specific location, e.g., the start of a runway or at a maintenance facility, and heading of the **runup** operation in the above user-defined example must be specified in the RUNWAYS section of the input file as discussed earlier in this section. A technical discussion of the airplane engine **runup** capability is presented in Appendix **C.** 

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## • SETWP::

TITLE <EXAMPLE IMPLEMENTATION OF APPROACH RUNWAY THRESHOLD>
AIRPORT <RUNWAY THRESHOLD EXAMPLE>

ALTITUDE 23 TEMPERATURE 12.66 C

#### RUNWAYS

The above runway definition is depicted graphically below:

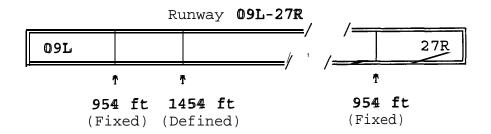


FIGURE 2-3:: RUNWAY DEFINITION

### 3. REFERENCES

- Flythe, M.C., Integrated Noise Model Version 3, User's Guide Revision 1, Report No. DOT/FAA/EE-922/022, Arlington, VA: CACI, Inc. Federal, June 1992.
- Bishop, D.E., Mills, J.F., <u>Update</u> of Aircraft Profile Data for the <u>Integrated Noise Model Computer Program, Volume 1</u>, Report No. FAA-EE-91-02, Canoga Park, CA: Acoustical Analysis Associates, Inc., March 1992.
- Bishop, **D.E.**, Mills, **J.F.**, <u>Update of Aircraft Profile Data for the Integrated Noise Model Computer Program, Volume 2, Report No. **FAA-EE-911-002, Canoga** Park, CA: Acoustical Analysis Associates, Inc., March **1992**.</u>
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- Procedure for the Calculation of Airplane Noise in the Vicinity of Airports, SAE/AIR 1845, Warrendale, PA: Society of Automotive Engineers Committee A-21, Aircraft Noise, 1986.
- Federal Aviation Regulations, Part 36, Noise Standards:
  Aircraft Type and Airworthiness Certification, Washington,
  D.C.: Federal Aviation Administration, December 1988.

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- Flythe, M.C., Integrated Noise Model Version 3, User's Guide Revision 1, Report No. DOT/FAA/EE-922/022, Arlington, VA: CACI, Inc. Federal, June 1992.
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  D.C.: Federal Aviation Administration, December 1988.

#### APPENDIX A

#### REVISIONS TO INM ALGORITHMS

This Appendix discusses, in general terms, revisions to several algorithms and subroutines included in INN Version 4.11.. discusses the rationale for these revisions and presents their effects on the noise contours, where applicable. The associated All revisions discussed computer source code is not included. below are transparent to the user in that they do not affect useroperation of the INM. However, these revisions will result in more accurate INM noise predictions and an increase in INM computational (1)revisions to They include: efficiency. (2) implementation of significance testing within the INM; (3) revisions to the dipole directivity smoothing equation; directivity pattern within the INM; and (4) revisions to the INM Data Base.

# A.1 Flight Significance Testing.

The methodology employed for determining flight noise significance during grid computations has been streamlined in **INM** Version **4.11**.. Rather than looping through each of the first four refinement levels individually and constructing the noise grid on a **level-by-**level basis, **INM** Version **4.11** begins by constructing the **17-by-17** point regular grid previously associated with the fourth refinement level, and setting all parameters associated with the **289** total points, including the noise significance flags for each point.

In restructuring the flight significance methodology, it was discovered that INM Version 3.10 was performing unnecessary (i.e., insignificant) noise computations due to improper setting of the flight significance flags. This impropriety had no effect on the computed noise levels but it did increase run-time unnecessarily. Revising the methodology for grid development, including the proper setting of flight significance flags, improved computation time by an estimated 40 percent over INM Version 3.10, for comparable input cases.

# A.2 Directivity Smoothing Equation

The directivity algorithm of SAE/AIR 1845 implemented for receivers behind start-of-takeoff roll, which is based on field-measured data published in 1980, has been maintained within INM Version 4.11. However, a directivity smoothing equation, operating as a function of distance, has been implemented. In previous versions of the INM, the directivity algorithm is applied to noise levels behind start-of-takeoff-roll regardless of lateral distance. In the 1980 study, measurements were made at distances from start-of-takeofff-roll of only 970 to 1280 ft. Recent studies: have indicated that INM Version 3.10 tends to underpredict noise levels behind start-of-takeoff-roll at distances of 3000 to 5000 ft, well beyond those represented in the 1980 study. This underprediction was especially evident for measurements made directly behind the airplane where

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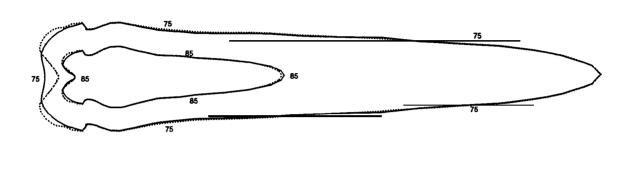
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The effect of the modified **directivity** pattern on the noise contours is depicted in Figures A-3 and A-4, below. Figure A-3 shows the effect on the SEL footprint for a single takeoff operation of the B737-200 airplane (INM number 47).. Figure A-4 shows the effect on the LDN contour for the INM Input Testcase provided with INM Version 3.10..



---- INM VERSION 3.10
AND BEFORE
----- INM VERSION 4.11

FIGURE A-3: SEL TAKEOFF FOOTPRINT COMPARISON FOR B737-200 AIRPLANE

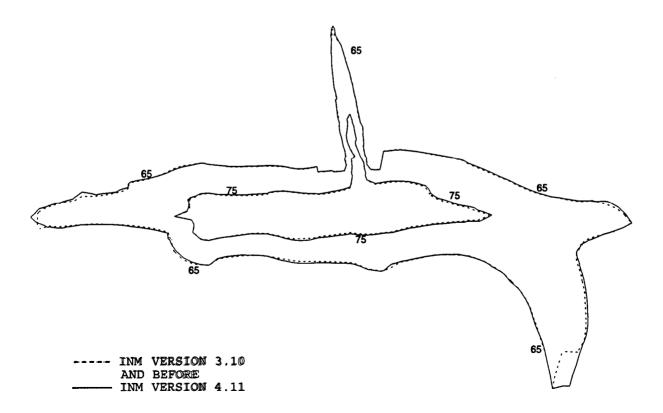
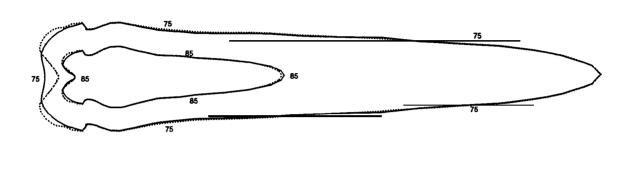


FIGURE A-4: LDN CONTOUR COMPARISON FOR INM INPUT TESTCASE

The effect of the modified **directivity** pattern on the noise contours is depicted in Figures A-3 and A-4, below. Figure A-3 shows the effect on the SEL footprint for a single takeoff operation of the B737-200 airplane (INM number 47).. Figure A-4 shows the effect on the LDN contour for the INM Input Testcase provided with INM Version 3.10..



---- INM VERSION 3.10
AND BEFORE
----- INM VERSION 4.11

FIGURE A-3: SEL TAKEOFF FOOTPRINT COMPARISON FOR B737-200 AIRPLANE

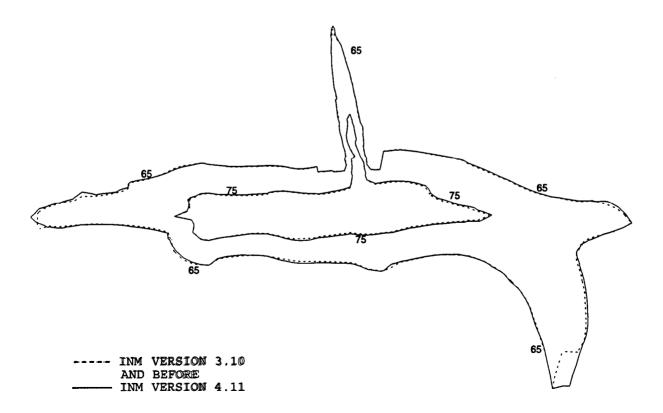
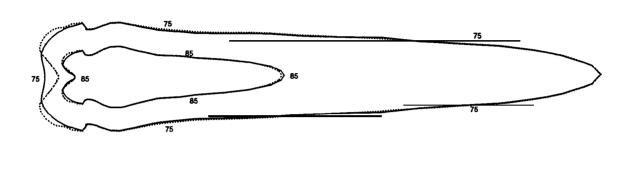


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AND BEFORE
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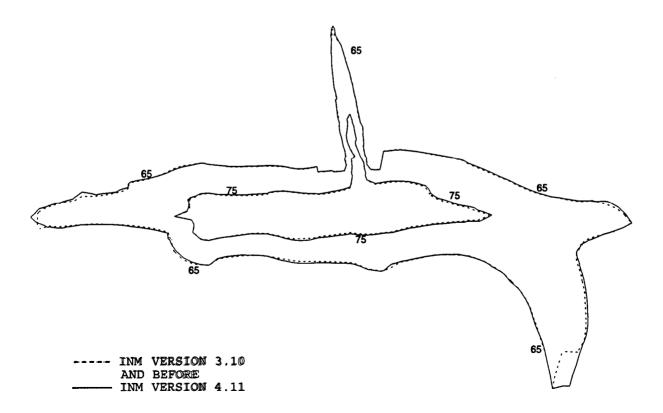


FIGURE A-4: LDN CONTOUR COMPARISON FOR INM INPUT TESTCASE

Standard Temperature, "F:  $T_{fap} \equiv T_{f0} \equiv 59.0$ 

Standard Temperature,  $\mathcal{CC}$ :  $T_{cap} \equiv T_{c0} = 15.0$ 

Standard Temperature,  $ORR: T_{rap} \equiv T_{r0} = 518.67$ 

Temperature Ratio: THETA =  $1-[((I))(H_x)/T_{x0}]$ , where  $H_x$  is the

altitude MSL for segment

point X

Pressure Ratio: DELTA = THETA(g/((Rc)(L)))

Density Ratio: SIGMA = THETA ((sp/((Re) (L))))-11]

Airport Elevation MSL:  $H_{ap} = 0.0 \text{ ft}$ 

Brake Release Gross Weight = W

Number of Engines
supplying Thrust = N

### GROUND ROLL SEGMENT

For the ground roll segment the following apply:

Airport Temperature:  $T_{c1} = T_{c2} = T_{cap}$ 

Pressure

Altitude MSL:  $H_a = H_2 = H_{ap}$ 

Initial Calibrated

Airspeed:  $V_{ci} = 16.0 \text{ kts}$ 

Given the above, the remaining parameters for the ground roll segment are computed as follows:

Initial Thrusst:  $\mathbf{Th}_{1} = \mathbf{E} + \mathbf{F}((\mathbf{N}_{\sigma_{1}})) + \mathbf{G}_{1}((\mathbf{H}_{1})) + \mathbf{G}_{2}((\mathbf{H}_{1}))^{2} + \mathbf{H}((\mathbf{\Pi}_{\sigma_{1}}))$ 

Final Calibrated

Airspeed:  $y_{c2} = (6) (W)_{H}^{Y}$ 

Final Airplane

True Speed:  $V_{c2}$  =  $V_{c2}/(SIGMA)^{1/3}$ 

Final Thrust:  $Th_2 = E + F((V_{\alpha 2})) + G_1((H_2)) + G_2((H_2))^2 + H((T_{\alpha 2}))$ 

Segment Horizontall

Length:  $S_{\alpha} = [(B) (THETA) (W)/DELTA)^{2} / [(N) Th_{2}]$ 

where E, F, G<sub>1</sub>, G<sub>2</sub>, and H are engine-dependent coefficients from Data Base Number 11 for maximum takeoff thrust mode;

C is a coefficient from Data Base Number 11 which is appropriate to the takeoff flap/slat settimg;

B is a coefficient from Data Base Number 11 which is appropriate to a specific airplane/flap-deflection combination, and varies only with the takeoff flap/slat setting; and

SIGMA, THETA, and DELTA, defined above, are constants equal to 1 at sea level.

Standard Temperature,"  $T_{tap} = T_{to} = 59.0$ 

Standard Temperature,  $\mathcal{CC}$ :  $T_{cap} \equiv T_{c0} = 15.0$ 

Standard Temperature,  $OR: T_{rap} \equiv T_{r0} = 518.67$ 

Temperature Ratio: THETA =  $1-[((I))(H_x)/T_{x0}]$ , where  $H_x$  is the

altitude MSL for segment

point X

N

Pressure Ratio: DELTA = THETA(g/((Rc)(L)))

Density Ratio: SIGMA = THETA ((sp/((Re) (L))))-11]

Airport Elevation MSL:  $H_{ap} = 0.0 \text{ ft}$ 

Brake Release Gross Weight = W

Number of Engines
supplying Thrust

#### GROUND ROLL SEGMENT

For the ground roll segment the following apply:

Airport Temperature:  $T_{c1} = T_{c2} = T_{cap}$ 

Pressure

Altitude MSL:  $H_a = H_2 = H_{ap}$ 

Initial Calibrated

Airspeed:  $V_{ci} = 16.0 \text{ kts}$ 

Given the above, the remaining parameters for the ground roll segment are computed as follows:

Initial Thrusst:  $Th_1 = E + F((V_{(T)})) + G_1((H_1)) + G_2((H_1))^2 + H((T_{(T)})$ 

Final Calibrated

Airspeed:  $y_{c2} = (6) (W)_{H}^{y}$ 

Final Airplane

True Speed:  $V_{c2}$  =  $V_{c2}/(SIGMA)^{1/3}$ 

Final Thrust:  $Th_2 = E + F((V_{\alpha 2})) + G_1((H_2)) + G_2((H_2))^2 + H((T_{\alpha 2}))$ 

Segment Horizontall

Length:  $S_{\alpha} = [(B) (THETA) (W)/DELTA)^{2} / [(N) Th_{2}]$ 

where E, F, G<sub>1</sub>, G<sub>2</sub>, and H are engine-dependent coefficients from Data Base Number 11 for maximum takeoff thrust mode;

C is a coefficient from Data Base Number II which is appropriate to the takeoff flap/slat setting;

B is a coefficient from Data Base Number 11 which is appropriate to a specific airplane/flap-deflection combination, and varies only with the takeoff flap/slat setting; and

SIGMA, THETA, and DELTA, defined above, are constants equal to 1 at sea level.

Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

R is a coefficient from Data Base Number 11 which is the nondimensional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplane configuration. The landing gear is assumed to be retracted.

### ACCELERATION SEGMENT

For acceleration segments the following apply:

Initial Calibrated Airspeed:	$v_{ei}$	=	V2 of the previous segment
Initial Airplane True Speed:	$v_{ti}$	=	$V_{t2}$ of the previous segment
Initial Thrust:	Th,	=	${ m Th}_2$ of the previous segment
Initial Temperature:	Tca	=	$\mathbf{T}_{\mathbf{c}2}^{\prime\prime}$ of the previous segment
Initial Pressure Altitude MSL::	Hì	=	H <sub>2</sub> of the previous segment
Final Calibrated Airspeed:	$V_{c2}$	•	As specified in the standard flight procedure
Rate-off-Climb:	$V_{\dot{\epsilon}z}$	=	As specified in the standard flight procedure

Given the above, computation of the remaining parameters is performed using an iterative procedure to arrive at the altitude increment, **DelH**. If the difference between **DelH** and **DelH**<sub>c</sub> (the computed altitude increment for the current iteration) is greater than one **ft**, **DelH** is set equal to **DelH**<sub>c</sub>, and the iterative process is repeated until a difference of one **ft** or less is achieved.

Initial Assumed
Altitude Increment: DelH = 250 ft

# Start of Iterative Loop:

Final Segment Altitude MSL:  $H_2 = H_1 + DelH$ 

Final Segment Temperatures:  $T_{c2} = \{ [T_{fap} - L(H_2)] - 32 \} (5/9) \}$ 

Final True Spect:  $y_{t2} \equiv v_{c2}/(SIGMA)^{*}$ 

Final Segment Thrust:: Th<sub>2</sub> = E + F( $(V_{e2})$ ) + G<sub>1</sub>( $(H_2)$ ) + G<sub>2</sub>( $(H_2)$ )<sup>2</sup> + H( $(IT_{e2})$ )

Average Segment Thaw =  $0.5((Th_1 + Th_2))$ 

Average. True Speed:  $V_{tavg} = 0.5 (V_{ta} + V_{te})$ 

Average Segment

 $H_1 + 0.5$ DelH Altitude: Havg =

Average Airplane

W// {[THE型A] (g/t (Rd) (L))) 1 } Weight: Wavg

Sine of the

 $V_{rz}//(101.266866V_{rave})$ Flight Angle:  $SIN_{ang} =$ 

Flight Angle: GAMMA = arcsim \$SNN<sub>ang</sub>)

0.042062 (V<sub>1</sub>2<sup>2</sup> - W<sub>1</sub>2<sup>2</sup>) Horizontall Segment

Distance:  $[(N)(Th_{avg})/M_{AVg}] - R_{avg} - SIN_{ang}$ 

Computed Altitude

Increment:  $DellH_c =$  $S_{q}$  [tan (GAMMA)]] ((1/0.95))

Deviation of the Computed Altitude Increment from the Altitude Increment Assumed at the Start

of the Current

abs[DelH. - DelH] DEV Iteration Cycle

At this point the status of the iterative process is checked. If DEV is less than 1 ft, then the iterative process is complete. Otherwise,

Altitude

Increment: DelH = DellH,

and the iterative process is repeated as above.

where  $E_{n}$   $F_{n}$   $G_{L,n}$   $G_{2}$ , and H are engine-dependent coefficients from Data Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

Ravg is a coefficient from Data Base Number 11 which is the nondimensional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplame configuration. The landing gear is assumed to be retracted.

#### THRUST REDUCTION SEGMENT

A thrust reduction segment of **1000 ft** (horizontal distance) is introduced to allow for a smooth transition of the thrust associated with the Federal Aviation Regulations, Part 36 thrust This segment replaces the first 1000 ft of cutback point. horizontal distance of the next segment which may be either a climb Computation of the parameters an acceleration segment. associated with the thrust reduction segment and the next segment is performed simultaneously. For the thrust reduction segment the following apply:

Initial Calibrated

Airspeed:  $\mathbf{v}_{e\mathbf{i}}$  $V_{c2}$  of the previous segment

Initial Pressure

H<sub>2</sub> of the previous segment Altitude MSL:  $\mathbf{H}_n$ 

Tel of the previous segment Initial Temperature:  $\mathbf{T}_{\mathbf{c}\mathbf{i}}$ 

Average Segment

 $H_1 + 0.5$ DelH Altitude: Havg =

Average Airplane

W// {[THE型A] (g/t (Rd) (L))) 1 } Weight: Wavg

Sine of the

 $V_{rz}//(101.266866V_{rave})$ Flight Angle:  $SIN_{ang} =$ 

Flight Angle: GAMMA = arcsim \$SNN<sub>ang</sub>)

0.042062 (V<sub>1</sub>2<sup>2</sup> - W<sub>1</sub>2<sup>2</sup>) Horizontall Segment

Distance:  $[(N)(Th_{avg})/M_{AVg}] - R_{avg} - SIN_{ang}$ 

Computed Altitude

Increment:  $DellH_c =$  $S_{q}$  [tan (GAMMA)]] ((1/0.95))

Deviation of the Computed Altitude Increment from the Altitude Increment Assumed at the Start

of the Current

abs[DelH. - DelH] DEV Iteration Cycle

At this point the status of the iterative process is checked. If DEV is less than 1 ft, then the iterative process is complete. Otherwise,

Altitude

Increment: DelH = DellH,

and the iterative process is repeated as above.

where  $E_{\prime\prime}$   $F_{\prime\prime}$   $G_{L\prime\prime}$   $G_{2}$ , and H are engine-dependent coefficients from Data Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

Ravg is a coefficient from Data Base Number 11 which is the nondimensional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplame configuration. The landing gear is assumed to be retracted.

#### THRUST REDUCTION SEGMENT

A thrust reduction segment of **1000 ft** (horizontal distance) is introduced to allow for a smooth transition of the thrust associated with the Federal Aviation Regulations, Part 36 thrust This segment replaces the first 1000 ft of cutback point. horizontal distance of the next segment which may be either a climb Computation of the parameters an acceleration segment. associated with the thrust reduction segment and the next segment is performed simultaneously. For the thrust reduction segment the following apply:

Initial Calibrated

Airspeed:  $\mathbf{v}_{e\mathbf{i}}$  $V_{c2}$  of the previous segment

Initial Pressure

H<sub>2</sub> of the previous segment Altitude MSL:  $\mathbf{H}_n$ 

Tel of the previous segment Initial Temperature:  $\mathbf{T}_{\mathbf{c}\mathbf{i}}$ 

Average Segment

 $H_1 + 0.5$ DelH Altitude: Havg =

Average Airplane

W// {[THE型A] (g/t (Rd) (L))) 1 } Weight: Wavg

Sine of the

 $V_{rz}//(101.266866V_{rave})$ Flight Angle:  $SIN_{ang} =$ 

Flight Angle: GAMMA = arcsim \$SNN<sub>ang</sub>)

0.042062 (V<sub>1</sub>2<sup>2</sup> - W<sub>1</sub>2<sup>2</sup>) Horizontall Segment

Distance:  $[(N)(Th_{avg})/M_{AVg}] - R_{avg} - SIN_{ang}$ 

Computed Altitude

Increment:  $DellH_c =$  $S_{q}$  [tan (GAMMA)]] ((1/0.95))

Deviation of the Computed Altitude Increment from the Altitude Increment Assumed at the Start

of the Current

abs[DelH. - DelH] DEV Iteration Cycle

At this point the status of the iterative process is checked. If DEV is less than 1 ft, then the iterative process is complete. Otherwise,

Altitude

Increment: DelH = DellH,

and the iterative process is repeated as above.

where  $E_{\prime\prime}$   $F_{\prime\prime}$   $G_{L\prime\prime}$   $G_{2}$ , and H are engine-dependent coefficients from Data Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

Ravg is a coefficient from Data Base Number 11 which is the nondimensional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplame configuration. The landing gear is assumed to be retracted.

#### THRUST REDUCTION SEGMENT

A thrust reduction segment of **1000 ft** (horizontal distance) is introduced to allow for a smooth transition of the thrust associated with the Federal Aviation Regulations, Part 36 thrust This segment replaces the first 1000 ft of cutback point. horizontal distance of the next segment which may be either a climb Computation of the parameters an acceleration segment. associated with the thrust reduction segment and the next segment is performed simultaneously. For the thrust reduction segment the following apply:

Initial Calibrated

Airspeed:  $\mathbf{v}_{e\mathbf{i}}$  $V_{c2}$  of the previous segment

Initial Pressure

H<sub>2</sub> of the previous segment Altitude MSL:  $\mathbf{H}_n$ 

Tel of the previous segment Initial Temperature:  $\mathbf{T}_{\mathbf{c}\mathbf{i}}$ 

Non-Standard

\$16MA\_((1/(b/((RRC)(LL))-1]))) THETA\_s= Temperature Ratio:

Non-Standard

THETA ( gg/ ( (Rc) (L) ) ) DELTA...= Pressure Ratio:

#### GROUND ROLL SEGMENT

For the ground roll segment the following apply:

 $(T_{fap} = 32) (5/9)$  $T_{c2}$  $T_{c1}$ Airport Temperature:

 $\mathbf{H}_{a}$  $H_{2}$ Hap Pressure Altitude MSL:

Initial Calibrated

 $V_{c1}$ 16.0 kts = Airspeed:

Given the above, the remaining parameters for the ground roll segment under non-standard conditions are computed as in Section B.I., Standard Conditions, using the non-standard THETA, SIGMA, and DELTA, as appropriate.

#### CLIMB SEGMENT

The parameters for the climb segment under non-standard conditions are computed as in Section B.1, Standard Conditions, using the nonstandard THETA, SIGMA, and DELTA, as appropriate.

### ACCELERATION SEGMENT

With the exception of the iterative process described below, the parameters for the acceleration segment under non-standard conditions are computed as in Section **B.1**, Standard Conditions, using the non-standard THETA, SIGMA, and DELTA, as appropriate.

Computation of the remaining parameters is performed using an iterative procedure to arrive at the horizontal distance of the segment,  $S_{qq}$ . If the difference between  $S_{qq}$  and  $S_{qc}$  (the computed horizontal distance for the current iteration) is greater than ten ft,  $s_{cms}$  is set equal to the arithmetic average of  $s_{cms}$  and  $s_{cms}$  and the iterative process is repeated until a difference of ten ft or less is achieved.

Initial Assumed Horizontal Distance:

S, computed for standard

conditions

The equations for the acceleration segment under standard conditions are used to supplement the following non-standard computations:

Start of Iterative Loop:

Tangemit of the

TAN ang 0.95 (DelH/S\_) Flight Angle:

Sine of the

Flight Angle: SIN<sub>ang</sub>= sin[[arctatn(ATAN<sub>ang</sub>)]

Computed Horizontal

Distance:

$$\mathbf{S}_{ge} = \frac{(\frac{1}{2}g)(0.95)(\sqrt{12} - \sqrt{12})}{[\ln(\text{Th}_{avg})1] - R_{avg} - \text{SAN}_{avg}}$$

Deviation of the Computed Horizontal Distance from the Horizontal Distance Assumed at the Start of the Current

Iteration Cycle: DEV = abs[Sqc - Sqns]

At this point the status of the iterative process is checked. If DEV is less than ten ft, then the iterative process is complete. Otherwise,

Horizontall

$$S_{g_{ns}}^{ns} = 0.5I[S_{g_c} + S_{gns}]$$

and the iterative process is repeated as above.

where E, F,  $G_1$ ,  $G_2$ , and H are engine-dependent coefficients from Data Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

 $R_{\rm avg}$  is a coefficient from Data Base Number 11 which is the non-dynemsional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplane configuration. The landing gear is assumed to be retracted.

#### THRUST REDUCTION SEGMENT

The parameters for the thrust reduction segment under non-standard conditions are computed as in Section **B.I.**, Standard Conditions, using the non-standard THETA, SIGMA, and DELTA, as appropriate.

## ERROR CHECKING

The non-standard portion of the profile generator maintains several built-in error checks which guard against the computation of improper takeoff profiles. Computation of takeoff profiles is not performed if any of the following conditions are detected:

- (1) the computed flight angle for a climb segment is zero or negative;
- (2) the computed horizontal distance for an acceleration segment is zero or negative;
- (3) the number of iterations required to compute the horizontal distance of an acceleration segment exceeds five hundred; and

Sine of the

Flight Angle: SIN<sub>ang</sub>= sin[[arctatn(ATAN<sub>ang</sub>)]

Computed Horizontal

Distance:

$$\mathbf{S}_{ge} = \frac{(\frac{1}{2}g)(0.95)(\sqrt{12} - \sqrt{12})}{[\ln(\text{Th}_{avg})1] - R_{avg} - \text{SAN}_{avg}}$$

Deviation of the Computed Horizontal Distance from the Horizontal Distance Assumed at the Start of the Current

Iteration Cycle: DEV = abs[Sqc - Sqns]

At this point the status of the iterative process is checked. If DEV is less than ten ft, then the iterative process is complete. Otherwise,

Horizontall

$$S_{g_{ns}}^{ns} = 0.5I[S_{g_c} + S_{gns}]$$

and the iterative process is repeated as above.

where E, F,  $G_1$ ,  $G_2$ , and H are engine-dependent coefficients from Data Base Number 11 for the thrust mode defined in the standard takeoff procedure; and

 $R_{\rm avg}$  is a coefficient from Data Base Number 11 which is the non-dynemsional ratio of the airplane's drag coefficient to lift coefficient for a given flap setting and airplane configuration. The landing gear is assumed to be retracted.

#### THRUST REDUCTION SEGMENT

The parameters for the thrust reduction segment under non-standard conditions are computed as in Section **B.I.**, Standard Conditions, using the non-standard THETA, SIGMA, and DELTA, as appropriate.

## ERROR CHECKING

The non-standard portion of the profile generator maintains several built-in error checks which guard against the computation of improper takeoff profiles. Computation of takeoff profiles is not performed if any of the following conditions are detected:

- (1) the computed flight angle for a climb segment is zero or negative;
- (2) the computed horizontal distance for an acceleration segment is zero or negative;
- (3) the number of iterations required to compute the horizontal distance of an acceleration segment exceeds five hundred; and

Table B-1: Runway requirements/operational boundaries of the profile generator, temperature  ${\bf 590F}$  , elevation  ${\bf 0}$  FT  ${\bf MSL}$ 

	1			STAGE WEIGHT			
INM #				STAGE WEIGHT			
	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	
2	4624	5004	5400	6352	7630	9173	10579
3	3719	4057	4501	5067	6644	6871	
4	2616	2926	3240	3752	4503	5309	6699
5	3846	4157	4481	5257	6297	7545	8679
6	4193	4671	5438	6551	8098	9433	
7	3963	4429	5176	6263	7767	8547	
8	2721	3109	3523	4193	4671		
9	3279	3739	4160	4913	5992	7186	8080
10	2799	3128	3656	4424	5486	6037	
11	2684	3034	3405	4006	4436		
12	3000	3338	3879	4666	5754	6709	
13	3705	4054	4607	5400	6483	7180	8167
14	3357	3684	4204	4956	5989	6660	7614
15	2693	3335	3959				
16	3279	3739	4160	4913	5992	7186	8080
17	3705	4054	4607	5400	6483	7180	8167
18	6967	6967	8556	8556	9799	9799	
19	3997	4389	4943	5838	6813	7868	
20	3371	3656	3954	4609	5534	6575	7799
21	4669	5071	5463	6353	7614	9032	10657
22	5052	5383	5900	6443	7610	8883	
23	4611	4897	5343	5811	6741	7747	8869
24	5968	6863	7821	8841			
25	4513	5004	5522	6146			
	5460	6050	6913	8098	9476		
26	5979	6964	8028	9074	3476		
	<del> </del>			<del></del>			
28	4513	5004	5522	6146			
29	5460	6050	6913	8098	9476		
30	5263	6120	6965	7699			
31	3352	3846	4285	5206	6369		
32	3414	3703	4015	4587	5362	6268	6811
33	3020	3274	3549	4062	4765	5576	5970
34	3067	3467	3924	4411	5328	6299	
35	3506	3981	4489	5506			
36	3187	3681	4135	5041			
37	4221	4827	5609				
38	3292	4035					
39	3184	3746	4612				
40	3634	4416	5227				
41	2124	2638	3133				
42	3075	3310	3893	4618			
43	3634	4416	5227				
44	2124	2638	3133			***	
45	3075	3310	3893	4618			
46	3653	4186	4839				
47	3303	3688	4096	4526			
48	3897	4708	5601				
49	3685	4155	4728	5991		***	
50	4002	4548	5131	6493			
	2616		3091	3573	4214	• <u>•</u> •	· 
52	2747	2960	3219	3692	4376	5123	
53	2826			->-	5370	5	
51	2569		•••	_37.	•••	533	•••
55	3689		F-2-	52.9	533-	6.23	***
	2002		_ <del></del>				

Table B-1: Runway requirements/operational boundaries of the profile generator, temperature  ${\bf 590F}$  , elevation  ${\bf 0}$  FT  ${\bf MSL}$ 

	T			STAGE WEIGHT			
INM #				STAGE WEIGHT			
2	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	
2	4624	5004	5400	6352	7630	9173	10579
3	3719	4057	4501	5067	6644	6871	
4	2616	2926	3240	3752	4503	5309	6699
5	3846	4157	4481	5257	6297	7545	8679
6	4193	4671	5438	6551	8098	9433	
7	3963	4429	5176	6263	7767	8547	
8	2721	3109	3523	4193	4671		
9	3279	3739	4160	4913	5992	7186	8080
10	2799	3128	3656	4424	5486	6037	
11	2684	3034	3405	4006	4436		
12	3000	3338	3879	4666	5754	6709	
13	3705	4054	4607	5400	6483	7180	8167
14	3357	3684	4204	4956	5989	6660	7614
15	2693	3335	3959				
16	3279	3739	4160	4913	5992	7186	8080
17	3705	4054	4607	5400	6483	7180	8167
18	6967	6967	8556	8556	9799	9799	
19	3997	4389	4943	5838	6813	7868	
20	3371	3656	3954	4609	5534	6575	7799
21	4669	5071	5463	6353	7614	9032	10657
22	5052	5383	5900	6443	7610	8883	
23	4611	4897	5343	5811	6741	7747	8869
24	5968	6863	7821	8841			
25	4513	5004	5522	6146			
	5460	6050	6913	8098	9476		
26	5979	6964	8028	9074	3476		
	<del>                                     </del>			<del></del>			<del></del> -
28	4513	5004	5522	6146			
29	5460	6050	6913	8098	9476		
30	5263	6120	6965	7699			
31	3352	3846	4285	5206	6369		
32	3414	3703	4015	4587	5362	6268	6811
33	3020	3274	3549	4062	4765	5576	5970
34	3067	3467	3924	4411	5328	6299	
35	3506	3981	4489	5506			
36	3187	3681	4135	5041			
37	4221	4827	5609				
38	3292	4035					
39	3184	3746	4612				
40	3634	4416	5227				
41	2124	2638	3133				
42	3075	3310	3893	4618			•••
43	3634	4416	5227				
44	2124	2638	3133			***	
45	3075	3310	3893	4618			
46	3653	4186	4839				
47	3303	3688	4096	4526			
48	3897	4708	5601				
49	3685	4155	4728	5991			
	1002	4548	b131	6493			
51	2616	2016	3691	3573	4216	• <u>•</u> •	
52	2747	2960	3219	3692	4376	5123	
53	2826			=>=	es	•	
54	2569						
55		•••	•••	_s.	•••		
	3689		87 <u>.</u>	-2.5	537	6.2	

Table B-2:: Runway requirements/operational boundaries of the profile generator, temperature  $40\,^{\circ}F$  , elevation 0 FT MSL

	1			STAGE WEIGHT			
INM #				T	<del>-</del>		
	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	0.722
12	4/218/4	4663	4969	9843	7020	8439	9733
I i	1 3422	I 3732	1 4141	1 4662	6112	6322	<u> </u>
4	2406	2692	2981	3451	4142	4884	6163
5	3538	3824	4122	4837	5793	6942	7984
6	4193	4671	5438	6551	8098	9433	
7	3963	4429	5176	6263	7767	8547	
В	2721	3109	3523	4193	4671		
9	3017	3440	3827	4520	5512	6611	7434
10	2799	3128	3656	4424	5486	6037	
11	2470	2791	ı 3133	3080806	40021	ā <u>.a.</u>	
12	2760	3070	3569	4293	5294	6172	
13	3409	3729	4238	4968	5964	6606	7514
14	3088	3389	3868	4559	5510	6127	7005
15	2478	3068	3642				
16	3017	3440	3827	4520	5512	6611	7434
			ļ	4968	5964	6606	<del> </del>
17	3409	3729	4238		<del> </del>	<u> </u>	7514
18	6410	6410	7872	7872	9015	9015	
19	3677	4038	4547	5371	6268	7239	
20	3101	3364	3638	<i>\$2</i> 40	9091	6049	7175
21	4295	4666	9025	9844	7005	8309	9804
22	4648	4952	5428	5928	7001	8172	•••
23	4242	<b>4</b> 505	4916	5346	6202	7127	8159
24	5968	6863	7821	8841		<u></u>	
25	1.52	I 4604	5080b	9694			
26	9023	9566	6360	7450	8718	# <u>*</u> *	-2-
27	9900	6407	7386	Bi) 477	2.6%	433	2.23
28	4152	4604	9080	5694	2.52	• 2.9	***
29	5023	9566	6366	1496	8718	<u>•-</u> i	•••
30	1942	5630	: 646 <b>8</b>	7683			
- 11	3084.	I 1539	3942	47/80s	9860	I	
32	3141	3407	3694	1220	4933	5767	6266
33	2778	3012	3265	37/37	43:84	5130	5492
34	2822	3389	3610	4058	49/02	5795	
35	3226	3663	4130	9065	#37a	•==	0.55
36	2928	3392	3799	4631			<u> </u>
377	3883	44,40	9160				<u>-</u>
38	3029	37712		<u> </u>   <u>_</u>			-
39	2930	3446	4243	i.		   F <u>u</u> ū	2.53
40	33P43	4062	4809	1	=3.0		
41	1954	2427	2983	<del></del>	-}	F33	
42	2829	3045	3581	4249		1	1
43	33113	4062	4909		4.00		
	1954	242-7		423	643	653	2.42
46			2883	622 4240	23.5	4.47	6.0.3
45	2829	3045	3581	4219	227	***	29.2
46	3361	3951	<b>4452</b>	1//	83°-	4.23	6 <u>.</u> 3
47 I -	FAF	3393	3//0608	4 hOE/4	<u>• •</u> •	ā <u>.</u> ā	
49	3/3/3/3	4332	5153				<u>.</u>
49	3390	308/2/2	4349	9512	<u> </u>	<u> </u>	
50	3681	41/81	4720	5974	630	4.0.0	9.03
51	2434	2619	2843	3287	3879	<b>73%</b>	=
	2526	2722	2961	3395	4024	47/12	>
52							
	2600	EBT:	9,47	22.7	423	***	537
52		en.	£474	***	m to	:51 211	534 543

Table B-2:: Runway requirements/operational boundaries of the profile generator, temperature  $40\,^{\circ}F$  , elevation 0 FT MSL

				STAGE WEIGHT			
INM #	-		1 ,		5	6	7
	1 4250	2	5223	5042	<del> </del>	7788	
1 7	4358	4603	4969	5842	7545	8439	9733
II 22 I i	1 3422		1 4141	1	6112	6372	9733
	2406	2692	2981	. 4662 . 3451	4142	4884	6163
5	3538	3824	4122	4837	5793	6942	7984
<del></del>	4193	4671	5438	6551	8098	9433	
7	3963	4429	5176	6263	7767	8547	
<del></del>	2721	3109	3523	4193	4671		
9	3017	3440	3827	4520	5512	6611	7434
10	2799	3128	3656	4424	5486	6037	
11	2476	2/91	31333	306365	1001	i	
12	2760	3070	3569	4293	5294	6172	
13	3409	3729	4238	4968	5964	6606	7514
14	3088	3389	3868	4559	5510	6127	7005
15	2478	3068	3642				
16	3017	3440	3827	4520	5512	6611	7434
17	3409	3729	4238	4968	5964	6606	7514
18	6410	6410	7872	7872	9015	9015	7524
19	3677	4038	4547	5371	6268	7239	<del></del>
20	36//	3364	3638	4240	5091	6049	7175
21	4295	4666	5026	5844	7005	8309	9804
22	4648	4952	5428	5928	7001	8172	
23	4242	4505	4916	5346	6202	7127	8159
24	5968	6863	7821	8841		- <u>u-</u>	
I 25	4152	I 4604	5080b	9694	وفو ا		
26	5023	5566	6360	7450	8718		
27	5500	6407	7386	8347			
28	4152	4604	5080	5654			
29	5023	9566	6360	7490	9718	<u></u> i	
36	4342	5630	6408	7683			
	3084	I 1539	3942	47/89	9860	·	<u> </u>
32	3141	3407	3694	1220	4933	57677	6266
33	2778	3012	3265	3737	43:84	5130	5492
34	2822	3189	3610	4058	49/02	5795	
35	3226	3663	4130	9065	633	***	***
36	2928	3382	3799	4631	<u> </u>		
377	30003	44,40	9160				
I 38	30029	3/12	i <u></u>				•••
39	2936	3146	4243			F_2	2.50
40	3334,3	4062	4809	3 <u></u>			<u>• •</u> •
41	1954	2427	2983		± <u></u>	F270	
42	2829	3049	3581	4249	3 <u>00</u>	•	***
4,3	33113	4062	4809	že?	643	42.5	<u>re</u>
416	1954	242-7	2883	£300	23.3	4,4%	
45	2829	3045	3581	4219	***	3.0.0	233
46	3361	3851	4452	2.2.5	63°	4.23	6.23
47 I -	_ ,039	3393	37/080B	4 11/16/4			
498	3585	4332	5153		<u>.</u>		
49	3390	38222	4349	9512		i	
50	3681	41/81	4720	5974	633	422	2.23
50	2434	2619	2843	3:2:97	387/9	930	
51							1
	2526	2722	2961	3395	4024	47/12	***
51		2722	2961	3395	1024	47/12	520
51 52	2526						

TABLE 8-3:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$ , ELEVATION 0 FT MSL

				COLCE LIEROUS			
INM #				STAGE WEIGHT			
*****	1	2	3	4	5	6	7
111	4358	4732	5223	5842	7545	7789	1
2	5693	5468	5901	6941	9338	10624	11561
	40064	4433	4919	9937	7260	7509	<u> </u>
4	2858	3198	3541	4100	4920	5801	7321
5	4202	4542	4896	5745	6881	8245	9494
6	4193	4671	5438	6551	8098	9433	<u></u> *
7	3963	4429	5176	6263	7767	85477	***
8	2721	3109	3923	4193	4671	<u>.</u>	4
9	3583	4086	4545	5369	6548	7852	8830
10	2799	3128	3656	4424	5486	6037	222
11	2933	3315	37721	437/8	4847	2.5"	E334
12~~~	~~ 3278	3647	4239	5099	6289	7332	
13	4049	4430	5034	5901	7084	7846	8925
1%	2943	3544	4326	5415	65 <u>44</u>	7277	8320 -
16	3583	4086	4545	5369	6548	7852	8830
17	4049	4430	5034	5901	7084	7846	8925
18	7614	7614	9350	9350	10708	10708	
19	4368	4797	5401	6380	7445	8598	
20	3683	3995	4321	5037	6047	7185	8523
21	9162	5942	9970	6942	8321	9870	11646
22	5521	5882	644.6	7041	8315	9707	<u>.</u>
23	9039	5351	5639	6350b	7366	8465	9692
24	5968	6863	7821	8841			ويات
25	4932	5468	6034	6716	***	a 2.	
26	5967	6612	7554	8849	1035\$	22%	6787-
<u> </u>							
27	6533	7610	8773	9915	•••	٠;٠	~ 7
			8773 6034				~ <u>••</u> • 7
28	4932	5468	6034	6716			
28 29	4932 5967	5468 6612	6034 7554	6716 8849	-	•	-
28	4932	5468	6034	6716	10393		•••
28 29 30 31	4932 9967 5751 3663	5468 6612 6688 4203	6634   1854   7611   4693	6716 8849 8413 9689	10325		 
28 29 30 31 32	4932 5967 5751 3663 3731	5468 6612 6688 4203 4047	6634 7654 7611 4693	8849 8413 9689 5012	10323		   7443
28 29 30 31 32 33	4932 9967 5751 3663 3731 3300	5468 6612 6688 4203 4047 3578	6634 7654 7611 4693 4387 3878	6716 8849 8413 9689 5012 4439	103%5  6960 5860 9207	   6850 6094	7443
28 29 30 31 32 33 34	4932 9967 5751 3663 3731 3300 3332	5468 6612 6688 4203 4947 3578 3788	6634 7614 7611 4683 4387 3878 4287	6716 8949 8413 9689 5012 4439	103%5  6960 5860 9207 5823		7443
28 29 30 31 32 33	4932 9967 5751 3663 3731 3300	5468 6612 6688 4203 4047 3578	6634 7654 7611 4693 4387 3878	6716 8849 8413 9689 5012 4439	103%3 	6850 6850 6883	7443
28 29 30 31 32 33 34 35 36	4932 9967 5751 3663 3731 3300 3332 3832 3832	5468 6612 6688 4283 4047 3578 3788 4351 4229	6834 7514 7611 4683 4387 3878 4287 4905 4526	6716 8849 8413 5689 5012 4439 4820 6016	103%3 	6850 6850 6883	7443
28 29 30 31 32 33 34 35 36 37	4932 9967 5751 3663 3731 3300 3332 3832 3832 3488 4613	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274	6034 7534 7612 4583 4387 3678 4287 4905 4526 6129	6716 8849 8413 5689 5012 4439 4820 6016 9516	103%3 	6850 6850 6883	7443
28 29 30 31 32 33 34 35 36 37 38	4932 9967 5751 3663 3731 3300 3332 3832 3488 4613 3598	5468 6612 6688 4203 4847 3578 3788 4351 4029 5274	6834 7514 7611 4683 4387 3878 4287 4905 4526	6716 8849 8413 5689 5012 4439 4820 6016	10395 	6850 6850 6863	7443
28 29 30 31 32 33 34 35 36 37 38	4932 9967 5751 3663 3731 3300 3332 3832 3832 3488 4613	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274	6034 7534 7612 4583 4387 3878 4287 4905 4526 6129	6716 8849 8413 5689 5012 4439 4820 6016 9516	10393 	6850 6850 6894 6883	7443
28 29 30 31 32 33 34 35 36 37 38 1 39	4932 5967 5751 3663 3731 3300 3332 3832 3498 4613 3598 2490 3971	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4825	6034 7534 7611 6633 4387 3878 4287 4905 4526 6129  5040 5712	6716 8849 8413 9689 5012 4439 4820 6016 9518	10393 6960 5860 9207 5823	6850	7443
28 29 30 31 32 33 34 35 36 37 38 I 29	4932 5967 5751 3663 3731 3300 3352 3832 3488 4613 3598 2480	5468 6612 6688 4203 4947 3578 3788 4351 4029 5274 4409 I 4093	6034 7554 7611 4693 4387 3878 4287 4905 4526 6129 2 5040 9712 3424	6716 8849 8413 5689 5012 4439 4820 6016 9516	10393 	6850	7443
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42	4932 9967 5751 3663 3731 3300 3332 3832 3498 4613 3998 2490 3971 2321	5468 6612 6688 4203 4047 3578 3788 4351 4029 5274 4409 I 4093 4223 2883 3617	6034 7554 7611 46583 4387 4387 4905 4526 6129  5040 5712 3424 4254	6716 8849 8413 9689 5012 4439 4820 6016 9518 	10335 	6850	7443
28 29 30 31 32 33 34 35 36 37 38 1 39 40 41 42 43	4932 5967 5751 3663 3731 3300 3332 3832 3832 3488 4613 3598 3480 3971 2321 3361	5468 6612 6688 4203 4947 3578 3788 4351 4029 5274 4409 I 4093 4825 2883 3617 4825	6034 7554 7611 46583 4387 4905 4287 4905 4526 6129 5040 5712 3424 4254 5712	6716 8849 8413 9689 5012 4439 4820 6016 9516  5047	10335 	6850	7443
28 29 30 31 32 33 34 35 36 37 38 I 29 40 41 42 43 44	4932 5967 5751 3663 3731 3300 3332 3832 3488 4613 3598 2480 3971 2321 3361 3971	5468 6612 6688 4203 4947 3578 3788 4351 4029 5274 4409 I 4093 4825 2983 3617 4225	6034 7854 7611 46583 4387 4905 4287 4905 4526 6129 5040 5712 3424 4254 5712 3424	6716 8849 8413 9689 5012 4439 4820 6016 9518  9047	10335 	6850	7443
28 29 30 31 32 33 34 35 36 37 38 1 39 40 41 42 43 44 45	4932 5967 5751 3663 3731 3300 3332 3832 3488 4613 3598 2480 3971 2321 3361	5468 6612 6688 4203 4947 3578 3788 4351 4029 5274 4409 I 4093 4825 2883 3617 4825	6034 7654 7611 4693 4397 3878 4287 4905 4526 6129 2 5040 5712 3424 4254	6716 8849 8413 9689 5012 4439 4820 6016 9516  5047	10335 	6850 6894 6883	7443
28 29 30 31 32 33 34 35 36 37 38 I 29 40 41 42 43 44 45	4932 5967 5751 3663 3731 3300 33\$2 3832 3832 3488 4613 3598 2480 3971 2321 3361 3971 2321 3361 3992	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4825 2883 3617 45/4	6034 7554 7611 4693 4397 4905 4526 6129 255 6129 255 5040 5712 3424 4254 5712 3424 4254 5288	6716 8849 8413 9689 5012 4439 4820 6016 9516 9047	10395 	6850	7443
28 29 30 31 32 33 34 35 36 37 38 I 29 40 41 42 43 44 45 46 47	4932 5967 5751 3663 3731 3300 3332 3832 3832 3488 4613 3598 2480 3971 2321 3361 3971 2321 3361 3992 3609	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4825 2083 3617 4825 2083 3617 45/4 4030	6034 7554 7611 6633 4387 3878 4287 4905 4526 6129 5040 5712 3424 4254 5712 3424 4254 9288	6716 8849 8413 9689 5012 4439 4820 6016 9516 9547 9047 4946	10395 6960 5860 9207 5823 	6850 6850 6850 6883	7443
28 29 30 31 32 33 34 35 36 37 38 1 39 40 41 42 43 44 45 46 47	4932 5967 5751 3663 3731 3300 3332 3832 3832 3498 4613 3998 3490 3971 2321 3361 3971 2321 3361 3992 3609 4238	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4825 2083 3617 4825 2083 3617 45/4 4030 9145	6034 7554 7611 6633 4387 3878 4287 4905 4526 6129 5040 5712 3424 4254 5712 3424 4254 5288   4476	6716 8849 8413 5689 5012 4439 4820 6016 9516  9047  9047  4946	10395 6960 5860 9207 5823 	6850 6850 6850 6883 	7443 6924 123 133 134 135 135 135 135 135 135 135 135 135 135
28 29 30 31 32 33 34 35 36 37 38 1 39 40 41 42 43 44 45 46 47 48 1 49	4932 5967 5751 3663 3731 3100 3332 3832 3832 3498 4613 3598 2490 3971 2321 3361 3971 2321 3361 3971 2321 3361 3992 3609 4238	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4825 2083 3617 4825 2083 3617 4540 9145 I 4540	6034 7554 7611 6633 4387 3878 4387 4905 4526 6129 2 5040 5712 3424 4254 5712 3424 4254 5268 6121 9166	6716 8849 8413 5689 5012 4439 4820 6016 9518  5047  9047  4946	10393 6960 5860 9207 5823 	6850 6850 6094 6883 	7443 6924 
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42 43 44 45 46 47 48 I 49 50	4932 5967 5751 3663 3731 3100 3332 3832 3498 4613 3598 2490 3971 2321 3361 3971 2321 3361 3992 36699 4288 4027 4373	5468 6612 6688 4203 4047 3578 3788 4351 4029 5274 4409 I 4093 4223 2083 3617 4825 2083 3617 455/4 4030 9145 I 4540	6034 7554 7611 6893 4397 3878 4287 4905 4526 6129 2 5040 9712 3424 4254 5712 3424 4254 5268 6121 9166 5607	6716 8849 8413 5689 5012 4439 4820 6016 9518 5047 5047 6547 7095	10393 6960 5860 9207 5823 	6850 6850 6850 6883 	7443 6924 
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42 43 44 45 46 47 48 I 49 50 51	4932 9967 5751 3663 3731 3300 3332 3832 3832 3832 3498 4613 3598 2490 3971 2321 3361 3971 2321 3361 3992 3609 4238 4027 4373 2891	5468 6612 6688 4203 4047 3578 3780 4351 4029 5274 4409 I 4093 4223 2083 3617 4825 2083 3617 4544 4030 9145 I 4540	6034 7554 7611 4683 4387 4387 4905 4526 6129 2 5040 5712 3424 4254 5712 3424 4254 9288 1 4476 6121 9166 5607	6716 8849 8413 9689 5012 4439 4820 6016 9518 5047 9047 4946 6547 7095	10393 6960 5860 9207 5823 	6850 6850 6850 6883 1 6883 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	7443 6924 
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42 43 44 45 46 47 48 I 49 50 51 52	4932 9967 5751 3663 3731 3300 3332 3832 3832 3498 4613 3598 2490 3971 2321 3361 3971 2321 3361 3992 3609 4228 4027 4373 2891 3002	5468 6612 6688 4203 4047 3578 3788 4351 4029 5274 4409 I 4093 4223 2083 3617 4825 2083 3617 455/4 4030 9145 I 4540	6034 7554 7611 4683 4387 4387 4905 4287 4905 4526 6129 2 5040 5712 3424 4254 5712 3424 4254 5268 6121 5166 5607 3377 3519	6716 8849 8413 9689 5012 4439 4820 6016 9518 9047 9047 4946 6547 7095 3904	10393 6960 5860 9207 5823 	6850 6850 6850 6883 	7443 6924 
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42 43 44 45 46 47 48 I 49 50 51 52 53	4932 9967 5751 3663 3731 3300 3332 3832 3832 3498 4613 3998 2490 3971 2321 3361 3971 2321 3361 3992 3609 4288 4027 4373 2891 3002 3088	5468 6612 6688 4203 4947 3878 3788 4351 4029 5274 4409 I 4093 4825 2983 3617 4825 2983 3617 4544 4030 9145 I 4540 4970 3111 3236	6034 7554 7611 4683 4387 4387 4905 4526 6129 2 5040 5712 3424 4254 5712 3424 4254 9288 1 4476 6121 9166 5607	6716 8849 8413 9689 5012 4439 4820 6016 9518 9047 9047 4946 6547 7095 39904	10393 6960 5860 9207 5823 	6850 6850 6850 6883 1 6883 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	7443 6924 
28 29 30 31 32 33 34 35 36 37 38 I 39 40 41 42 43 44 45 46 47 48 I 49 50 51 52	4932 9967 5751 3663 3731 3300 3332 3832 3832 3498 4613 3598 2490 3971 2321 3361 3971 2321 3361 3992 3609 4228 4027 4373 2891 3002	5468 6612 6688 4203 4947 3578 3788 4351 4029 5274 4409 I 4093 4825 2883 3617 4825 2983 3617 4544 4030 9145 I 4540 4970 3111 3236	6034 7554 7611 4683 4387 4387 4905 4287 4905 4526 6129 2 5040 5712 3424 4254 5712 3424 4254 5268 6121 5166 5607 3377 3519	6716 8849 8413 9689 5012 4439 4820 6016 9518 9047 9047 4946 6547 7095 3904	10335 	6850 6850 6850 6883 	200

Table B-3:: Runway requirements/operational boundaries OF the profile generator, temperature  $80\,^{\circ}F$  , elevation 0 FT MSL (Continued)

		STAGE WEIGHT										
INM #	1	2	3	4	5	6	1					
56	4136			_===		••-	<u></u> ~					
§ <del>7</del> 7	3421											
58	3823			<u></u>		•••						
59	40671			<u> </u>		===	===					
66	3246	_==_		_===	===		±5±					
61	5404		***		2.27		••-					
62	4260		5370									
63	3006	3787	5111		537	55%	831.9					
64	1961		5.23	2.53	£23-	ED.	27.0					
65	1850	627		637	***		***					
66	4302	5485	6558		4-7		***					
677	2941		537	627		523	es-					
68	2853		£_7	***	•_63	e==-	•••					
69	1361		527	•	627	***	***					
70	3546	466363	6014	2.52								
71	1694	2069	0	7.5			I					
72	1997	2599	ē.e.>	5.43	2,4%	2.5%	FV.					
73	2321											
74	704											
75	823											
76	1766				<del> </del>							
77	780											
78	11509											
79	4538	7077					<del></del>					
80	56377	7720	i <u>.</u> -	ā <u></u>	0.2	i	i					
81	5622	<del>7</del> 504		_==		47.						
62	j 5707	I 6526					ē <u>.</u> ;					
93	4116	4582	4973	5806	6946	8590	9984					
84	4463	<b>#831</b>	5197	6109	7334	8799	10152					
85	3996	4646	5169	6304	251	44.9	8- <sub>32.9</sub>					
86	3901	4508	5066	6182	62%	237	*25					
87	3009	3262	3537	4052	4,754	5569	5963					
88	3215	3943	477:54	I.e.o	ووده	P.A.s	***					
89	3633	4464	5268	1		<u>•</u> 5 2	***					
90	3483	4255	5112	•••								
91	12306	_::				= 14.0	====					
92	10171	633	274.9	2.29	***	***	•••					
93	3544	3929	4493	5267	6169	# N						
94	3283	3640	401-7	4472		***	***					
95	3346		<u>.</u> e		47.9	#53	6.23					
96	4579	233-	623	623	rs.	443	فعة					
977	3978	47733	5637	6539	***	F33-	4 <u>.a</u> .2-					
98	4520	ī.v.	-2-2		433	- <u>-</u> -	4 <u></u>					
99	2652	<u>.</u> .e.	***	-4-	***	- <u>-</u> ->	€ <u>•</u> >					
100	<b>4513</b>	5004	5522	6146	£35	- <u>-</u> -	4 <u></u> 3					
101	5460	6050	6913	8098	9476	##L	627-					
102	4777	5163	5964	6563	7651	9004	10667					
	5199	5613	6055	7156	8358	9858	11708					
103	****	637·	***	<u>.</u>	25.5		2.45					
103	3000											
	3000		***	£200	504	***	•					
104			m EA	en en	5.5.a	F270	٠					

TABLE B-3:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$  , ELEVATION 0 FT MSL (CONTINUED)

		STAGE WEIGHT										
INM #	1	2	3	4	5	6	7					
56	4136	_===	_==	_===	_===		<u>.</u> ~					
§7	3421					<u></u> :	**					
SS	3823	<u>.</u>	<u>.</u>	<u>.</u>	=	<u></u> i	47 <u>.</u>					
59	40071		- <u></u>	<u> </u>	<u></u> :	=3-						
60	3246	-2-	222	<u>.</u> ==	=7.5		<u>.</u>					
61	5404		***		a_e~	F33	**_					
62	4260		£270				===					
63	3006	3787	5111	9.0.3	227	50%	F71.9					
64	1961	e.÷.o	5.23	2.53	625	ŁN.	E 72_9					
65	1.850	627	457	627		<i>-</i>	640					
66	4302	\$485	6558		2 <u>-</u> ~		4.60					
677	2941	***	537	627		527,	537					
68	2853		2.27	±		e20.						
69	1381		522		F22	***	***					
70	3546	4683	6014	<u>.</u>		<u>-</u>						
71	1694	2069	0		·n	427	455					
72	1997	2599		543			5 % To 10 Miles					
73	2321											
74	704											
75	823											
76	1766				T							
77	780				T		T					
78	11509											
79	4538	7077										
80	56377	7720a	- <u>-</u> -	<u></u>	9.2	-=1	i					
C <b>81</b>	5022	7504		9.5-		450						
62	j 5707	I 8526			23.5		4.2					
83	4116	4582	49773	5806	6946	8590	9984					
84	4463	<b>#831</b>	5197	6109	7334	8793	10152					
85	3996	4646	5169	6304	253	433	وية					
86	3901	4508	5066	6182			*25					
87	3009	3262	3537	4052	4754	5569	5963					
88	3215	3943	47754	***	ووه	2.5.5	e 3-2-					
89	3633	4,45,4	5268	1		-52	***					
90	3483	4/2353	5112	•=•								
91	12306					= 1.						
92	10171	en.	I-60	2.50	# P P P P P P P P P P P P P P P P P P P	6.02	•=•					
93	3544	3929	4493	5267	6169	# N	1					
94	3283	3640	4017	447/2	l <u>.</u>	1 #25	***					
95	3346	•••	· ·	2.53	474.9	#53	- e=3					
96	4579	50%	623	#22	ويوده	***	وعة					
977	3978	47/33	5637	6539	F75	<b>733</b>	4 <u>-</u> 2					
98	4520	<u>.</u>	=.2.4		***	• <u>•</u> •	< <u></u>					
99	2652	<u>.</u>	***		**_	***	4 <u>-</u> 2					
100	4513	5004	5522	6146	***	•	< <u>-</u> *					
	5460	6050	6913	8098	9476	0004	e=-					
101			5564	6563	7651	9004	⊉0667					
102	4777	5163	<u> </u>									
102	5189	5613	6055	7156	8358	9858	11708					
102 103 104	5189 3000		es.		8358	*	11708					
102 103 104 105	5189 3000 3000	5613			+		-					
102 103 104	5189 3000	5613	es.		n.,	*	2.00					

TABLE B-4: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $59\,^\circ F$  , ELEVATION  $3000\ FT\ MSL$  (CONTINUED)

	STAGE WEIGHT										
min #	1	2	3	4	5	6	7				
56	4136			22.5			22.				
57	3647										
58	<b>4240</b>					i					
59	4790	53°-					<u></u> :				
60	3458			<u>.</u>	-40						
<b>61</b>	5934			1							
62	4798	_63		_52	422	6 % To	***				
63	3261	4108	5545	5W-	<u>•</u> •	537	£ <u>.</u> 2				
64	2156	<u></u> -		3_0%	4	en-	# The .				
65	X464			***	÷						
66	4667	5951	7115								
67	3191	- F==					<u> </u>				
68	3095		<u> </u>		<u> </u>	<u> </u>	~~ •				
69	1499				430-						
70	3947	5081	6525				***				
71		2245	0								
	1838					***					
72		2820									
73	2518	<u>.</u>				====	•••				
74	764	_57	<u>-</u>								
<b>75.</b>	493			وقع ا	<u> </u>		·				
76	1916		] F±3-	! •••-		مِية ت	<u> </u>				
77	846				en-	•••					
78	134654	-20		<u></u> .	2.5-0	# Th.	23%				
79	5094	7944	-2-	2 <u>-</u> 2		·					
80	6328	8665	•••		6.0.0	-43					
91	5448	9141	9 8 9	4.9.9	2.00						
82	6192	9252	<u></u> -	4.00	<u></u>	·					
83	4637	5160	5599	6535	<del>7</del> 91s	9662	11228				
84	£043s	5439	98 1/2	6900	8281	9932	111857				
85	4563	\$235	5823	7099			<u>.</u>				
86	4233	I ,890	5494	6698		<u> </u>					
87	3464	3755	4071	4664	5471	6408	6861				
88	3717	0	0				***				
89	3949	4849	5718			<u>.</u> 5%	•••				
90	4008	4896	5881	- -							
91	13820										
•		<u></u>			<u> </u>						
92	11445			5985	7,0008	 					
93	4029 3800	4466	5106								
94		4214	4650	5176	ii.	-	1				
	3660			<u>-</u>	<u>.</u>	I	I <u>.</u>				
96	5268		4450		<u>.</u>	<u>.</u>	<u></u> .				
977	4693	5591	6659	7725	F 574	537-	>				
98	5066	-2-	£ <u></u>		F 27-	##P-					
99	2913	-co	#BTs	•••		23.0					
100	4513	5004	5522	6146	•_•		***				
101	5460	6050	6913	9098	9476		2.5				
102	4963	5367	5783	6816	7939	9335	11051				
103	5183	5603	6041	7131	8318	9796	11616				
104	3666		<u>.</u>	_51		<u>-</u> -					
105	3000		<u>-</u>	ī_ī.		<u></u> -					
106	3666		222	<u>.</u>			مغه				
	•		ı		*	•					

TABLE B-4: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $59\,^\circ F$  , ELEVATION  $3000\ FT\ MSL$  (CONTINUED)

		STAGE WEIGHT										
ning #	1	2	3	4	5	6	7					
96	4136			27.5			, , , , , , , , , , , , , , , , , , ,					
57	3647						<del></del>					
3 B	4216				<del></del>	===						
59	4790			<u> </u>								
60	3458					<u> </u>						
	5994				1 27							
62	47/9/8											
63	3261	4108	9545	-		533	5.23					
64	2156			2.5	4	gan.						
65	¥461											
66	. 46677	9991	7135									
		522		<u>t</u>			<u>i</u>					
67 68	3191			24.0	•••	1	<u>*</u> *					
69	3499 3499	1		1	1		~~ <u>*</u>					
70	3947	9081	6525		430-	400	وجة					
							g 12.					
71	3838	2245	0			# TOTAL						
72	21677	2820		<u>.</u>								
73	2939	<u>.</u>					•••					
<b>74</b> ]		727	<u>_</u>	<u>-</u>	===							
75.	993		_===	ا يقع	<u> </u>		I					
[ <del>7</del> 6 ]	1916	<del></del>	1 525	<u>••</u> -	1	1	1					
77	846	2.5%		2.53	# TOTAL	9.00	254					
78	13454	-2.2	<u></u> -	<u></u> •	9.9-9	537s	53%					
79	5094	7944	2.50	5_3		3_0 0						
80	6328	8665	9.02	223	2.00	2,53	9.5					
91	9448	<b>9143</b>	<u>. 5</u>	6.9.9	5 <u>00</u>							
82	6192	9252	<u></u> .	4.0.5	<u></u>							
83	4063th	5160	9599	6335	1818	9662	11228					
84	5043	5459	5872	6900	8281	9932	11457					
85	4503	5235	9823	7099			<u>.</u>					
<b>86</b> I	,233	I 4890	9494	6698	l <u></u>	I = <u></u>	I					
87	3464	3755	4071	4664	5471	6408	6861					
88	3717	0	0									
89	3949	4849	5718									
90	4008	4896	5881									
91	13820											
92	11445		<u>.</u>	<u></u>	<u> </u>							
93	4029	4 166	5106	9995	7,000%	ā- <u>a</u>						
94	3890	42h4	1696	9376								
95.	3660b		24.5	<u>-</u>	_==-							
<b>96</b>	5768				_=-							
97	4698	5591	6659	7725								
98	5066											
99	2913											
100	4513	5004	5522	6146								
101	5460	6050	6913	8098	9476		<del> </del>					
102	4968	5367	5783	6816	7939	9335	11051					
103	5183	5603	6041	7131	8318	9796	11616					
104	3000		===	===								
105	3000		<u>.</u>	= <u>-</u> -	<u>.</u>							
306	3000		222	<u>.</u>								

TABLE B-5: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $40\,^{\circ}F$  , ELEVATION  $3000\,^{\circ}FT$  MSL (CONTINUED)

				STAGE WEIGHT			
INM #	1	2	3	4	5	6	7
56	4136						
57	3355						
58	3901						
59	4407						
60	3181					<b></b>	
61	5514	<del> </del>				<del></del>	
62	4414				<del></del>		
63	2945	3710	5007				
-614 ~~	1000				·		1
-6 <b>b</b> s ~	T 1322		1   F <u>*</u> *	1 2_2	<u> </u>		
66	4214	5373	6124			1	
67	1		1	1		<u> </u>	257
	2881	<u>.</u>					<u> </u>
áù .	1 2795	1	1 ===	\$ === 	f ===	[ * <u>*</u> *	I <u>.</u>
69	1353	250		***	***	•	-2.0
70	347/4	4588	5892		•_•	.5-	300
73	1660	2027	0	y.Fb	4.2.0	4.0.0	2.5.9
72	1957	2546		2.5-	•=>	4=2	***
73	2274	523	8974	257	***	4.0.0	± <u></u>
74	690	2.25	==9		4.00		257
75	806	4.00	£374	6970	437-	4m2	-50
76	1730			252			1
77 ]	764	<u>.</u> =-		:			1
78	123777		<u></u> .	<u></u> .	14.5	<u></u> :	
79	4686	7308	9.5%	: <u>.</u> ;	\$7 <u></u>		<u> </u>
80	5822	7972		_==	<u> </u>		
81	4920	7351			42-h	<u> </u>	***
82	5591	8354		4 <u></u>	53 <u>0</u>	6276	<u></u> .
83	4266	47477	5151	6032	7199	8889	10329
84	4639	5022	5402	6348	7618	9137	10540
85	4343	4816	5357	6533	6_2	<u>.</u>	
86	3895	4499	5054	6162		2.5	~
		1		1			
87	3186	3455	3745	4/29/0	5033	5895	6312
88	3420	4193	ô	***	657		1
89	3633		5263		<u></u>		
90	3687	4505	5413	<u>••</u>		<u> </u>	<u> </u>
91	12695	623	4.5.5	2.50	7.Es	253	.57
92	10529	e.es	மு	2.00	2.50		425
93	3706	4108	4697	5506	6449	£#2	***
94	3496	3977	4279	4762		637	
95	3367			<u>.</u>		•••	•••
96	4846	F <u>e</u> F	<u></u> -	===			
	4322	5143	6126	116#		1 <u>-</u> -	
977							
977	4661						J
98	4661		<del></del>	<del></del>		<del> </del>	<del> </del>
98	4661 2680						
98 99 100 101	4661 2680 4513	5004	5522 6913	6146	9476		
98 99 100 101 102	4661 2680 4513 5460 4221	5004 6050 4563	5522 6913 4915	6145 8098 5790	9476	7923	9374
98 99 100 101 102 103	4661 2680 4513 5460 4224 4333	5004 6050 4563 4683	5522 6913 4915 5047	6145 8098 5790 5953	9476 6742 6939	  7923 8166	9374 9675
98 99 100 101 102 103	4661 2680 4513 5460 4224 4333 3000	5004 6050 4563 4683	5522 6913 4915 5047	6145 8098 5790 5953	9476 6742 6939	7923 9166	9374 9675
98 99 100 101 102 103	4661 2680 4513 5460 4224 4333	5004 6050 4563 4683	5522 6913 4915 5047	6145 8098 5790 5953	9476 6742 6939	  7923 8166	9374 9675

TABLE B-6:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$  , ELEVATION 3000 FT MSL

				STAGE WEIGHT			
INM #	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	
2	6283	6799	7336	8628	10362	12453	14358
3	5056	5514	6117	6885	9023	9332	
4	3557	3979	4405	5100	6120	7213	9099
5	5126	5540	5971	7003	8385	10044	11549
6	4193	4671	5438	6551	8098	9433	•••
7	3963	4429	5176	6263	7767	8547	
8	2721	3109	3523	4193	4671		
9	4402	5020	5583	6592	8037	9636	10833
			3656	4424	5486	6037	
10	2799	3128	4613	5426	6007		
11	3637	4110	5438	6541	8066	9405	•••
12	4205	4678			9079		
13	5189	5677	6452	7563		10056	11438
14	4519	4958	5658	6667	8055	8955	10236
15	3718	0	0				
16	4402	5020	5583	6592	8037	9636	10833
17	5189	5677	6452	7563	9079	10056	11438
18	9489	9489	11650	11650	13340	13340	
19	5638	6192	6973	8237	9613	11102	
20	4513	4895	5293	6168	7403	8794	10428
21	6558	7123	7673	8924	10696	12688	14971
22	6846	7293	7993	8728	10304	12025	
23	6277	6665	7272	7908	9171	10537	12062
24	5968	6863	7821	8841		•••	
25	6363	7056	7785	8666			
26	7382	8179	9344	10944	12805		
27	8377	9758	11249	12713			
28	6363	7056	7785	8666			
29	7382	8179	9344	10944	12805		
30	7126	8286	9429	10422			
31	4725	5422	6041	7339	8980		
32	4585	4973	5390	6157	7196	8409	9136
33	3940	4272	4629	5297	6211	7265	7777
34	3939	4450	5034	5657	6829	8068	
35	4545	5159	5814	7125			
36	4297	4962	5573	6792			
37	5931	6782	7881		5 <u>-</u> 5		•••
38 :		5464				ā <u></u>	
39	£3333	5096	6274	<u></u> :		<u>.</u>	
400	5082	6176	7311	ட	£1	- es	
<b>4</b> 1	2964	3681	4372	f Th	533	f.s.s	2.23
42	4324	4654	5473	6491		***	43.0
43	5082	6176	7311				
44	2964	3681	4372				
				6494			
45	4324	4654	5473				
46	5108	5852	6766	6129			
47	4473	4995	5547				
48   - i.i.	5240 .0.1/1	6330	7528	8076	•		
- kalis I	#\b/\d	9663	6373	8016	 I	<b>,</b>	
50	5495	6245	7045	8914			
51	3561	3831	4159	4807	5672		
52	3593	3871	4210	4825	5716	6689	•••
53	3690		£3%	****	2.5%	FEE	<u>.</u> ~
54	3586 5212	en-	5 <u>.</u> %	•••	es.	•••	52%

TABLE B-6:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$  , ELEVATION 3000 FT MSL

	STAGE WEIGHT									
INM #		1								
	1	2	3	4	5	6	7			
1	4358	4732	5223	5842	7545	7788				
2	6283	6799	7336	8628	10362	12453	14358			
13:	3868	5514	6117	6883	9023	9332				
4	3557	3979	4405	5100	6120	7213	9099			
5	5126	5540	5971	7003	8385	10044	11549			
6	4193	4671	5438	6551	8098	9433	•••			
7	3963	4429	5176	6263	7767	8547				
8	2721	3109	3523	4193	4671					
9	4402	5020	5583	6592	8037	9636	10833			
10	2799	3128	3656	4424	5486	6037				
11	3637	4110	4613	5426	6007					
12	4205	4678	5438	6541	8066	9405				
13	5189	5677	6452	7563	9079	10056	11438			
14	4519	4958	5658	6667	8055	8955	10236			
15	3718	0	0							
16	4402	5020	5583	6592	8037	9636	10833			
17	5189	5677	6452	7563	9079	10056	11438			
18	9489	9489	11650	11650	13340	13340				
19	5638	6192	6973	8237	9613	11102				
20	4513	4895	5293	6168	7403	8794	10428			
21	6558	7123	7673	8924	10696	12688	14971			
22	6846	7293	7993	8728	10304	12025				
23	6277	6665	7272	7908	9171	10537	12062			
24	5968	6863	7821	8841						
25	6363	7056	7785	8666						
26	7382	8179	9344	10944	12805					
27	8377	9758	11249	12713						
28	6363	7056	7785	8666						
29	7382	8179	9344	10944	12805					
30	7126	8286	9429	10422						
31	4725	5422	6041	7339	8980					
32	4585	4973	5390	6157	7196	8409	9136			
33	3940	4272	4629	5297	6211	7265	7777			
34	3939	4450	5034	5657	6829	8068				
35	4545	5159	5814	7125						
36	4297	4962	5573	6792						
		6782								
	1 4160	5464				<u>'</u>				
39	333	5096	6274	<u> </u>						
10	5082	6176	7311			254	242			
41	2964	3681	4372	m			2.23			
42	4324	4654	5473	6491		***	*3.5			
43	5082	6176	7311							
	2964	3681	4372							
44			5473	6494						
45	4324	4654								
46	5108	5852	6766							
47	4473	4995	5547	6129						
48 - i.i	5240	6330	7528	8076						
	1 49/10	5663	6373	8016						
50	5495	6245	7045	8914						
51	3561	3831	4159	4807	5672					
52	3593	3871	4210	4825	5716	6689	•••			
53	3690		***	76	2.00	FEL	<u>.</u>			
54	3586	##h	3 <u>.</u> %	•••	சு	•	53%			
55	5212	53.9		***		627				

TABLE B-6:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$  , ELEVATION 3000 FT MSL

				STAGE WEIGHT			
INM #	•	2	3	4	5	6	7
	1 4359	4732	5223	5842	7545	7788	
1	4358			8628	10362	12453	14358
2	6283 5054	6799 EE11	7336	/ 205			
13:	3000	5514	611#	6883	9023	9332	
4	3557	3979	4405	5100	6120	7213	9099
5	5126	5540	5971	7003	8385	10044	11549
6	4193	4671	5438	6551	8098	9433	
7	3963	4429	5176	6263	7767	8547	
8	2721	3109	3523	4193	4671		
9	4402	5020	5583	6592	8037	9636	10833
10	2799	3128	3656	4424	5486	6037	
11	3637	4110	4613	5426	6007		
12	4205	4678	5438	6541	8066	9405	
13	5189	5677	6452	7563	9079	10056	11438
14	4519	4958	5658	6667	8055	8955	10236
15	3718	0	0				
16	4402	5020	5583	6592	8037	9636	10933
17	5189	5677	6452	7563	9079	10056	11438
18	9489	9489	11650	11650	13340	13340	
19	5638	6192	6973	8237	9613	11102	
20	4513	4895	5293	6168	7403	8794	10428
21	6558	7123	7673	8924	10696	12688	14971
22	6846	7293	7993	8728	10304	12025	
23	6277	6665	7272	7908	9171	10537	12062
24	5968	6863	7821	8841			
25	6363	7056	7785	8666			
26	7382	8179	9344	10944	12805		
27	8377	9758	11249	12713			
28	6363	7056	7785	8666			
29	7382	8179	9344	10944	12805		
30	7126	8286	9429	10422			
31	4725	5422	6041	7339	8980		
32	4585	4973	5390	6157	7196	8409	9136
33	3940	4272	4629	5297	6211	7265	7777
34	3939	4450	5034	5657	6829	8068	
35	4545	5159	5814	7125			
36	4297	4962	5573	6792			
1	E001	6782	7881				
38	4160	5464				ā <u></u>	
39	<b>£333</b>	5096	6274	<u> </u>		<u>.</u>	
400	5082	6176	7311	_		-	
41	2964	3681	4372	633	533	6.0.0	2.03
42	4324	4654	5473	6491	•••	##T	*3.
43	5082	6176	7311				
			4372				
44	2964	3681	5473				
45	4324	4654		6494			
46	5108	5852	6766	6120			
47	4473	4995	5547	6129	•••		
48	.0.1/1	6330	7528	2016			
-   -     -	49Hd	5663	6373	8016			
50	5495	6245	7045	8914			
51	3561	3831	4159	4807	5672		
52	3593	3871	4210	4825	5716	6689	•••
53	3690		£2.7	T-6_9	2.5%	522	<u>.</u>
54	3586	e 37-2	* <u>.</u> *	***	en.	•••	52%
55	5212	2,5-0		***		623	

TABLE B-7: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE 59-9 , ELEVATION 6000 FT MSL (CONTINUED)

	STAGE WEIGHT									
INM #	1	2	3	4	5	6	7			
56	4136			et.,	_===	22.5				
57	4399		_	527	_	es,	<u> </u>			
58	5180		i <u>.</u> :	- <u></u> -		<u>-</u>	::			
59	6192									
60	4168									
61	7322									
62	6054									
63	3960	4989	6733							
64	2613									
65	1778									
66	5667	7225	8639							
67	3874		<del> </del>				<del> </del>			
68	3758	<del> </del>				<del></del>				
69	1820	+	<del> </del>			† <del></del> -				
70	4672	6169	7923							
	2232	2726	7,723	<del> </del>						
71		3424	<del> </del>							
72	2631	3424					<del> </del>			
73	3057	<del> </del>	<del> </del>							
74	928									
75	1084			<del> </del>		<del> </del>				
76	2327	ļ <del></del>								
77	1027									
78	17276									
79	6260	9762								
80	7779	10648								
81	6616	9885								
82	7519	11234								
83	5744	6391	6934	8092	9673	11956	13889			
84	6267	6783	7296	8571	10283	12329	14218			
85	5582	6488	7215	8794						
86	5073	5858	6578	8016						
87	4381	4749	5148	5897	6918	8101	8674			
88	0	0	0							
89	4739	5815	6854							
90	5068	6190	7434							
91	17102									
92	14072									
93	5034	5580	6378	7475	8753					
94	4833	5359	5913	6582						
95	4448									
96	6659									
97	6095	7253	8639	10023						
98	6323									
99	3528									
100	4513	5004	5522	6146						
101	5460	6050	6913	8098	9476					
102	6256	6758	7281	8581	9994	11750	13906			
103	6435	6955	7498	8848	10319	12149	14402			
104	3000	527	2.57	622	***	***	#27a			
105	3000			4.0	5.53	*				
106	3000	2.63	1.2	***	-		***			
107	3000			643	637	***	£37-			
	, <b>.</b>				L	I	ļ			

Table B-8: Runway requirements/operational boundaries of the profile generator, temperature  $40\,^{\circ}F$  , elevation 6000 FT MSL

		ERATURE 40°		STAGE WEIGHT			
INM #				57A55 W21GH1			
	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	
2	6652	7197	7766	9131	10964	13173	15186
3	5354	5838	6476	7288	9549	9876	
4	3768	4215	4666	5400	6479	7636	9630
5	5302	5729	6174	7240	8665	10376	11928
6	4193	4671	5438	6551	8098	9433	
<del>17₁  </del>	3963	1.29	51%	6263	7 h@ h	8547	<u></u> 1
18 I	2721	3109	3523	<b>4</b> 193	16#1		÷ <u></u> -
9	4553	5190	5772	6813	8304	9952	11187
10	2799	3128	3656	4424	5486	6037	
11	3811	4305	4832	5682	6290		
12	4564	5078	5902	7100	8756	10210	
13	5627	6157	6997	8202	9846	10906	12405
14	4718	5175	5904	6956	8401	9338	10671
15	0	0	0				
16	4553	5190	5772	6813	8304	9952	11187
17	5627	6157	6997	8202	9846	10906	12405
		10014	<del>                                     </del>	12293	14074		
18	10014	6763	12293 7616	8997	10501	14074	
20	4687	5083	5496	6404	7684	9124	10817
21	7132	7748	8346	9706	11634	13801	16285
22		7650			<del> </del>		
23	7182 6614	7023	8383 7661	9152 8330	10801 9659	12602	12600
			7821			11096	12698
24	5968 6885	7634	8423	8841			
		1		i I	Ī	<u> </u>	1
26	8030	8898	10165	11906	13930		
27	9155	10665	12295	13896			
28	6885	7634	8423	9376			
29	8030	8898	10165	11906	13930		
30	7749	9011	10254	11334			
31	5157	5917	6594	8011	9803		
32	4775	5178	5613	6409	7489	8749	9504
33	3999	4335	4697	5373	6297	7364	7881
34	3982	4497	5086	5714	6894	8140	
35	4586	5203	5862	7179			
36	4472	5163	5798	7064			
37	6455	713:811.	8577	2	gran-	•••	F=1-
38	4682	5736	•	•	E7 <u>e</u> a	#30s	5 <u></u> %
39	4569	5373	6613			- 12-	
40	5501	6689	7918	2.5%			***
41	3202	3977	47721	#37s	22-2	E 37-5	Ft.
42	4712	5071	5964	7077			
43	5504	6689	791.08	<u>.</u>		<u>.</u>	
44	3202	3977	47.21				
<b>15</b> :	4712	5071	5964	767,7	•••		
46	55300	6336	7312255	5 <u>4</u> 5	.v.	بوة	
47	4864	5432	6032	6665			
48	5464	6599	7846				
49	5198	5859	6665	8442			
50	5845	6643	7493	9480			
51	3717	3998	4340	5015	5917		
52	3651	3933	4276	4900	5802	6786	
53	3775						
54	308308	1	<u> </u>	<u> </u>	<u></u>		- <u> </u>
34							, - <u></u>

Table B-8: Runway requirements/operational boundaries of the profile generator, temperature  $40\,^{\circ}F$  , elevation 6000 FT MSL

	1			STAGE WEIGHT			
INM #				JIAGO WEIGHT			
	1	2	3	4	5	6	7
1	4358	4732	5223	5842	7545	7788	
2	6652	7197	7766	9131	10964	13173	15186
3	5354	5838	6476	7288	9549	9876	
4	3768	4215	4666	5400	6479	7636	9630
5	5302	5729	6174	7240	8665	10376	11928
6	4193	4671	5438	6551	8098	9433	
1 <i>7</i> <sup>7</sup>	3963	1429	51%	6263	1164	8547	<u></u> 1
18	2721	3109	3523	4193	16#1		÷ <u></u> -
9	4553	5190	5772	6813	8304	9952	11187
10	2799	3128	3656	4424	5486	6037	
11	3811	4305	4832	5682	6290		
12	4564	5078	5902	7100	8756	10210	
13	5627	6157	6997	8202	9846	10906	12405
14	4718	5175	5904	6956	8401	9338	10671
15	0	0	0				
16	4553	5190	5772	6813	8304	9952	11187
17	5627	6157	6997	8202	9846	10906	12405
18	10014	10014	12293	12293	14074	14074	
19	6158	6763	7616	8997	10501	12129	
20	4687	5083	5496	6404	7684	9124	10817
21	7132	7748	8346	9706	11634	13801	16285
22	7182	7650	8383	9152	10801	12602	
23	6614	7023	7661	8330	9659	11096	12698
24	5968	6863	7821	8841			
25	6883	7634	8423	9316			
26	8030	8898	10165	11906	13930		
27	9155	10665	12295	13896			
		<del> </del>					, ,
28	6885 8030	7634	8423	9376			
30		8898	10165	11906	13930		
31	7749	9011	10254	11334			
	5157	5917	6594	8011	9803		
32	4775	5178	5613	6409	7489	8749	9504
33	3999	4335	4697	5373	6297	7364	7881
34	3982	4497	5086	5714	6894	8140	
35	4586	5203	5862	7179			
36	4472	5163	5798	7064			
37	6455	7381	8577	•••	#27a		***
38	4682	5736		•••	87 <u>.</u> a	#37a	5_2
39	4569	5373	6613			***	• • •
40	5504	6689	7918	253			***
41	3202	3977	47/21	***	***	***	
42	4712 E EO/	5071 4400	5964	7077			
43	\$504   2202	2077	7968	<u></u>		<u>.</u>	1
44	3202	3944	4h24	077			
<b>45</b>		5071	5964	7 <b>.</b> 77777	•••		
E 46 1	5530	I 6336	7325		[	<u> </u>	<u></u>
47	4864	5432	6032	6665			
48	5464	6599	7846				
49	5198	5859	6665	8442		**-	
50	5845	6643	7493	9480			
51	3717	3998	4340	5015	5917		
52	3651	3933	4276	4900	5802	6786	
53	3775						
54	3838		·				-
55	5616		1			4 <u>-</u> 2	

Table B-8: Runway requirements/operational boundaries of the profile generator, temperature  $40\,^{\circ}F$  , elevation 6000 FT MSL

1	INM #	Į.			STAGE WEIGHT			
1 1 2 3 4 5 6 7 728					01702 W210111			
2 6652 7377 7766 9331 10064 13173 13586 3 5354 5538 6476 7388 9263 9976 4 3769 4315 4666 5800 6479 7265 9970 5 5102 5722 6124 7240 8665 10076 13124 6 4 3769 4471 5650 6551 8008 6439 7626 13124 6 4 3372 4671 5650 6551 8008 6433 7 77 3983 4229 9176 6551 8008 6433 7 77 3983 4229 9176 6551 8008 6433 7 77 3983 4229 9176 6551 8008 6433 7 79 3983 4229 9176 6551 8008 6433 7 70 3983 4229 9176 6083 4651 7 70 3983 4229 9176 6083 4651 10 2799 3128 3365 8423 6652 6290 11 3811 4105 4432 5662 6290 12 4544 5078 9392 7100 8756 30210 13 5627 6357 6397 8002 9846 10066 12405 14 6473 5575 5894 6956 8401 93318 10205 14 6473 5575 5894 6956 8401 93118 10205 14 6453 5130 5772 6413 1008 6401 93128 10205 14 6454 1008 640 1008 640 1008 640 1008 640 12405 15 0 0 0 0 0 0 14 6453 5130 5772 6413 1008 6401 93128 10205 15 0 0 0 0 0 0 16 1004 1008 1008 1008 1008 1008 1008 1008		1	2	3	4	5	6	7
3	1	4358	4732	5223	5842	7545	7788	
4   3768	2	6652	7197	7766	9131	10964	13173	15186
\$ \$102	3	5354	5838	6476	7288	9549	9876	
6	4	3768	4215	4666	5400	6479	7636	9630
T	5	5302	5729	6174	7240	8665	10376	11928
	6	4193	4671	5438	6551	8098	9433	
1	1 <i>7</i> <sup>1</sup>	3963	1429	51%	6263	1167	8547	:
10   2799   3128   3656   4424   5486   6027	18	2721	3109	3523	<b>≱1</b> 093	16#1		÷ <u></u>
11	9	4553	5190	5772	6813	8304	9952	11187
12	10	2799	3128	3656	4424	5486	6037	
13	11	3811	4305	4832	5682	6290		
14         4718         5175         5904         6956         8401         9318         10671           15         0 <td>12</td> <td>4564</td> <td>5078</td> <td>5902</td> <td>7100</td> <td>8756</td> <td>10210</td> <td></td>	12	4564	5078	5902	7100	8756	10210	
15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	13	5627	6157	6997	8202	9846	10906	12405
15 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0				<del></del>	<u> </u>	+		
16         4553         5390         5772         6813         8304         9952         11187           17         5627         6157         6997         8202         9846         10966         12405           18         10014         10014         12023         12223         12071         14074							<del></del>	
17         \$627         \$6157         \$6997         \$202         \$9846         \$10906         \$12405           18         \$10014         \$10293         \$12293         \$14074         \$14074         \$119         \$1518         \$6763         \$7616         \$8997         \$10501         \$1240         \$1021         \$1021         \$10201         \$1220         \$14074         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1021         \$1022         \$1				<del> </del>	6813		<u> </u>	
18							+	
19 6158 6761 7616 8997 10501 12129  20 4687 5082 5496 6404 7684 9124 10817  21 7132 7748 8346 9706 11614 13801 12602  22 7382 7650 8383 9152 10801 12602  23 6614 7023 7661 8330 9659 11096 12698  24 5968 6863 7821 8841  25 6885 7634 8423 9366  27 9155 10665 12295 13896  28 6885 7634 8423 9376  29 8030 8898 10165 11906 11930  20 10749 9011 10254 11334  31 5157 5917 6594 8011 9901  32 4775 5178 5613 6407 5373 6297 7364 7881 33 9399 4435 4597 5373 6297 7364 7881 33 9399 4435 5504 6669 5736  36 44472 5163 5736  37 6455 7381 8577  38 4682 5736  39 4669 5373 6613  40 5504 6669 7738 857  41 5505 6641 7925 7346  42 4712 5071 5964 7707  43 5504 6669 7738 857 6655 8442  46 5508 5855 6641 7733 9440  47 4864 5432 6033 4276 4900 5502 6786  51 2777 5177 3993 4379 6655 8442  48 5545 6641 7739 9440  49 5198 5859 6665 8442  40 5504 6669 7738 400 5015 5917  41 5198 5859 6665 8442  42 4712 5198 5859 6665 8442  43 5198 5859 6665 8442  44 55198 5859 6665 8442  45 5198 5859 6665 8442  46 5504 5664 5659 7733 9440  47 4864 5432 6032 6665 8442  48 5545 6641 7739 9440  50 5775 5177 5993 4276 4290 5502 6786  51 2777 3993 4276 4290 5502 6786  52 3651 3933 4276 4290 5502 6786  53 2777 5515 3933 4276 4290 5502 6786  54 550 5545 6641 7739 9440  55 50 5545 6641 7739 9440  55 50 5545 6641 7739 9440  55 50 5545 6641 7739 9440  55 50 5545 6641 7739 9440  55 50 5545 6641 7739 9440  57 50 5775 5775 5775 5775 5775 5775 57			_					
20				<del></del>	ļ		<del> </del>	
21 7132 7748 8346 9706 11634 13801 16285  22 7182 7550 8383 9152 10801 12602  23 6614 7023 7661 8330 9659 11096 12698  24 59568 6663 7421 8841  25 6883 7634 8423 9376  26 8303 8898 10165 11906 13930  27 9155 10665 12295 13896  28 6685 7634 8423 9376  29 8030 8898 10165 11906 13930  29 8030 8898 10165 11906 13930  21 9155 10565 12295 13896  22 8685 7634 8423 9376  23 6614 7073 8517 5917 6554 8011 9803  30 7749 9911 10254 11314  31 5157 5917 6554 8011 9803  32 4775 5378 5613 6409 7489 8749 9504  33 3999 4335 4697 5373 6297 7364 7881  34 1392 4497 5086 5714 6694 8140  35 4586 5203 5862 7179  36 4472 5363 5798 7064  37 6455 7381 8577  38 4662 5736  39 4569 5373 6613  40 5504 6669 7918  41 3202 3977 4728  42 4712 5571 5864 7077  43 5604 6689 7918  44 3202 3977 4728  45 4712 5571 5864 7077  46 549 6849 7828  47 4864 5492 6605 8442  48 5464 6599 7484  49 5198 5859 6665 8442  49 5198 5859 6665 8442  50 5845 6641 7493 9480  51 3717 3998 4340 5015 5917  52 3651 3931 4276 4900 5802 6726  53 13775					ļ	1		
22         7182         7650         8383         9152         10801         12602            23         6614         7023         7661         8330         9659         11096         12698           24         5968         6863         7821         8841              25         6885         7634         8423         9376              26         8030         8898         10165         11906         13930             27         9155         10665         12295         13896              28         6885         7634         8423         9376              29         8030         8898         10165         11906         13930              29         8030         8898         10165         11906         13930             30         7749         9011         10254         1334              31         3999         4335         4697						<del>                                     </del>	<del>-</del>	
21 6614 7023 7661 8330 9659 11096 12698 24 5968 6663 7621 8841 25 6885 7634 8423 9376 26 8030 8898 10165 11906 13930 27 9155 10665 12295 13896 28 6885 7634 8423 9376 29 8030 8898 103.65 11906 13930 310 7749 9011 10254 11334 31 5157 5517 6594 8011 9803 32 4775 53178 5513 6409 7489 8749 9504 33 3999 4335 4697 5373 6297 7364 7881 34 3982 44497 5086 5714 6894 8140 37 6455 7381 8577 37 6455 7381 8577			<del></del>			<del> </del>		1
24       5968       6863       7821       8841 <t< td=""><td></td><td></td><td></td><td>-</td><td><b>.</b></td><td></td><td></td><td>-</td></t<>				-	<b>.</b>			-
25 6885					-		<del></del>	-
26       8030       8898       10165       11906       13930           27       9155       10665       12295       13896            28       6885       7634       8423       9376            29       8030       8898       10165       11906       13930           30       7749       9011       10254       11334            31       5157       5917       6594       8011       9803           32       4775       5178       5613       6409       7489       8749       9504         33       33999       4335       4697       5373       6297       7364       7881         34       3982       4497       5086       5714       6894       8140          35       4586       5203       5862       7719            36       4472       5163       5798       7064            37       6455       7381       8577		l	-7701	1	1			
27         9155         10665         12295         13896  -			1	1		1		
28       6885       7634       8423       9376 <t< td=""><td></td><td></td><td><del></del></td><td></td><td></td><td></td><td></td><td></td></t<>			<del></del>					
29 8030 8898 10165 11906 11930			-	<del></del>	<del> </del>	· · ·		
10								
31       5157       5917       6594       8011       9803           32       4775       5178       5613       6409       7489       8749       9504         33       3999       4335       4697       5373       6297       7364       7881         34       3982       4497       5086       5714       6894       8140          35       4586       5203       5862       7179            36       4472       5163       5798       7064            37       6455       7381       8577             38       4662       5736              39       4569       5373       6613             40       5504       6689       7918             41       3202       3977       4724             42       4712       5071       5964       7077			· · · · · · · · · · · · · · · · · · ·					
12       4775       5178       5613       6409       7489       8749       9504         13       1999       4335       4697       5373       6297       7364       7881         34       1982       4497       5086       5714       6894       8140          35       4586       5203       5862       7179            36       4472       5163       5798       7064            37       6455       7381       8577             38       4682       5736              39       4569       5373       6613             40       5504       6689       7918             41       3202       3977       4724             43       5564       6689       7918             43       5564       5689       7945	30	7749	9011	10254	11334			
33       3999       4335       4697       5373       6297       7364       7881         34       3982       4497       5086       5714       6694       8140	31	5157	5917	6594	8011	9803		
34       3982       4497       5086       5714       6894       8140          35       4586       5203       5862       7179            36       4472       5163       5798       7064            37       6455       7381       8577              39       4569       5373       6613               40       5504       6689       7918	32	4775	5178	5613	6409	7489	8749	9504
35       4586       5203       5862       7179 <t< td=""><td>33</td><td>3999</td><td>4335</td><td>4697</td><td>5373</td><td>6297</td><td>7364</td><td>7881</td></t<>	33	3999	4335	4697	5373	6297	7364	7881
36       4472       5163       5798       7064 <t< td=""><td>34</td><td>3982</td><td>4497</td><td>5086</td><td>5714</td><td>6894</td><td>8140</td><td></td></t<>	34	3982	4497	5086	5714	6894	8140	
37 6455 7381 8577	35	4586	5203	5862	7179			
38	36	4472	5163	5798	7064			
39       4569       5373       6613 <td< td=""><td>37</td><td>6455</td><td>7381</td><td>8577</td><td></td><td>#30-</td><td>•••</td><td>g=2-</td></td<>	37	6455	7381	8577		#30-	•••	g=2-
40 5504 6689 7918	38	4682	5736		•••	n.,	#30s	5.23
41 3202 3977 4724	39	4569	5373	6613			27.5	***
42	40	5504	6689	7918	F.6.9	***		***
43	41	3202	3977	47721	#30-	5270	***	LF3
44 3202 3977 472	42	4712	5071	5964	7077			
45	43	5504	6689	79108	2.53		2,52	
45         4712         5071         5964         7076   <	44	3202	3977	47721				
16         553b         6336         7325 </td <td></td> <td></td> <td>5071</td> <td></td> <td>703777</td> <td>•••</td> <td></td> <td> </td>			5071		703777	•••		
47     4864     5432     6032     6665          48     5464     6599     7846           49     5198     5859     6665     8442          50     5845     6643     7493     9480          51     3717     3998     4340     5015     5917         52     3651     3933     4276     4900     5802     6786        53     3775			I 6336	7325	1	I		=
48     5464     6599     7846           49     5198     5859     6665     8442          50     5845     6643     7493     9480          51     3717     3998     4340     5015     5917         52     3651     3933     4276     4900     5802     6786        53     3775	1						1	
49     5198     5859     6665     8442          50     5845     6643     7493     9480          51     3717     3998     4340     5015     5917         52     3651     3933     4276     4900     5802     6786        53     3775			+	<del> </del>	ļ			
50     5845     6643     7493     9480          51     3717     3998     4340     5015     5917         52     3651     3933     4276     4900     5802     6786        53     3775				+	·	+		
51     3717     3998     4340     5015     5917         52     3651     3933     4276     4900     5802     6786        53     3775	-			<del>                                     </del>		<del></del>		<del>                                       </del>
52     3651     3933     4276     4900     5802     6786        53     3775			<del></del>	<del></del>		<del>                                     </del>	<del> </del>	<del></del>
53 3775		3/1/	3778	+	ļ	<del> </del>		
701)	51	2.55	20					
54   3838	51 52	<del></del>		-			<del> </del>	
55   5616	51 52 53	3775		-				

TABLE B-9:: RUNWAY REQUIREMENTS/OPERATIONAL BOUNDARIES OF THE PROFILE GENERATOR, TEMPERATURE  $80\,^{\circ}F$  , ELEVATION 6000 FT MSL (CONTINUED)

	1			STAGE WEIGHT			
inn #				SIMON WEIGHT			
	1	2	3	i i	5	6	7
56	4136			_		5.5	
57	4807	***	_		**;	_	***
58	5661	Far		_17	-2-		•••
59	6766	5_2					= <u></u>
60	4555						
61	9001 -					<u>-</u>   _	~~
62	6615	<u></u>		•===	<u>.</u>		<u>• •</u>
63	4414	5561	7505				
64	2855			<u></u> *	3 <u>.e</u> 3-	##T-	<u>.</u>
65	1982	2.2.9	-27	£27s	6379	2.5%	9.00
66	6317	8054	9629	- 23-	4	##C	2 <u>-</u> 2
67	4318					-12	***
68	4189		9,53	***	227	•••	537
69	2029	>		5 N			e=
70	52077	6876	B831	425		gan.	2.2
71	2487	3038	0				422
72	2933	3817	***			£	g=-
73	3408 ~ I	<u>'</u>		<u>-</u>	==		_1_
74	1034	<u>.</u> 22			ه تو و	<u>.</u> ::	
75	1268	<u>.</u> ::-	: <u>.</u> :	<u>.</u> ::		:	_11
76	2593	2.5%	637	==>		***	
77	1145	5_3			23 <u>.e</u>	#30-	
78	1887/8				>	-57	***
79	6B40	10668	=3	4	z	<u>.</u>	
80	8500	11636	E-676	8.0.9	#3t.s	27.9	en-
91	7374	11018	<u>.</u>	#30°=	200		<u></u>
82	8381	à				<u></u>	
83	6277	6983	7577	8842	10570	13065	15177
84	6848	7412	7973	9366	11237	13473	15537
85	6166	7890	7891	9609			
8G	9544	I 6.0h	nes	9799			
877	47/87/	5190	5626	6444	7559	8853	9478
88	0	0	0	5=3	523	23.0	23-0
89	9178	6354	7499	239	533	100	5.23
90	9938	6764	8124	2.23	2.27	9.5	•••
-9g <sub>1</sub> -7	18717				:_:	~	
92	15377					<u></u>	
93	ı	6697	6976	1169	9569		
93	9501 5101	5836	6462	1 7193			<u></u>
	4960			1		<u></u>	
95	1277	•••		I .		1	====
96		7926	9440	10953	_===-	<u> </u>	
	666@		9440		<u></u> >	<u>.</u>	<u></u>
98	6909	£270	.53	•••			,
99	3955	5004	8822	5 % A.C.	<u>.</u>	<u>.</u>	<u></u>
100	4513	9004	5522	6146	D.476	2.67	
101	5460	6050	6913	8098	947/6		***
102	7503	8107	8737	10302	12006	14124	16729
103	7878	8519	9187	10851	12665	14926	17713
104	3666						l .
105	3000					<u> </u>	
106	3000						يية ت
107	3000	<u>.</u>	ш-		***	E27	<u>.</u>

#### APPENDIX C

### AIRPLANE RUNUP OPERATIONS

This Appendix discusses the adaptation of an existing **INM** equation for use in computing **runup** noise within **INM** Version **4.11.**. This equation, also used in the Time-Above-Threshold (**TA**) equation, can be used to approximate the maximum A-weighted sound level (**LNA**) and the maximum tone-corrected perceived noise level (**PNLT**) for a one-second time period as follows:

$$\mathbf{L}_{\text{MMX}} = \text{SEL - 10log}_{10} \left[ \left( (500\text{m}) / (V) \right) (.001\text{R}_0) \right] \text{ and } (1)$$

EPNL = the Effective Perceived Noise
Level from the Noise-ProwerDistance data base (dB);

v = the airplane velocity (ft/sec);

k = a constant exponent with a fixed
value of 0.6 in the INM; and for
Equation ((2),)

10 = a duration correction as discussed in Section 2.3, Equation (2).

The above equations assume: (1) an approximate shape of an airplane's sound level time history; and (2) symmetry in the time history trace around the  $\mathbf{L}_{\mathtt{MMX}}$  or  $\mathbf{PNLT}_{\mathtt{MAX}}$ , as appropriate. The  $\mathbf{L}_{\mathtt{MMX}} \not = \mathbf{PNLT}_{\mathtt{MAX}}$  values computed with these equations were verified using measured  $\mathbf{L}_{\mathtt{MMX}} \not = \mathbf{PNLT}_{\mathtt{MAX}}$  data in the literature.'

Given the computed  $\mathbf{L}_{\overline{\text{MM}}}$  PNIIT<sub>MAX</sub> and the user-defined duration and location for a **runup**, the **SEL/EPNL** for the **runup** is computed by multiplying the acoustic energy associated with the  $\mathbf{L}_{\overline{\text{MM}}}$  PNIIT<sub>MAX</sub> by the user-defined duration, and converting the total **runup** energy to a decibel value as follows:

$$SEL_{pressure} = 10log_{10} \left( \frac{DURR 10exp(LL_{MA}/DU)}{and} \right)$$
 and (3)

#### APPENDIX C

### AIRPLANE RUNUP OPERATIONS

This Appendix discusses the adaptation of an existing **INM** equation for use in computing **runup** noise within **INM** Version **4.11.** This equation, also used in the Time-Above-Threshold (**TA**) equation, can be used to approximate the maximum A-weighted sound level (**LNAX**) and the maximum tone-corrected perceived noise level (**PNLT**<sub>NAX</sub>) for a one-second time period as follows:

$$\mathbf{L}_{\text{MMX}} = \text{SEL - 10log}_{10} \left[ \left( (500\text{m}) / (\text{V}) \right) \left( .00\text{LR}_0 \right) \right] \text{ and } (1)$$

$$PNLT_{MAX} = EPNL - 10log_{10}, [(((5007r))/(W))) ((.00lR))k^{(k)}] + 10, (2)$$

EPNL = the Effective Perceived Noise
Level from the Noise-ProwerDistance data base (dB);

v = the airplane velocity (ft/sec);

k = a constant exponent with a fixed
value of 0.6 in the INM; and for
Equation ((2),)

10 = a duration correction as discussed in Section 2.3, Equation (2).

The above equations assume: (1) an approximate shape of an airplane's sound level time history; and (2) symmetry in the time history trace around the  $\mathbf{L}_{\mathtt{MMX}}$  or  $\mathbf{PNLT}_{\mathtt{MAX}}$ , as appropriate. The  $\mathbf{L}_{\mathtt{MMX}} \not = \mathbf{PNLT}_{\mathtt{MAX}}$  values computed with these equations were verified using measured  $\mathbf{L}_{\mathtt{MMX}} \not = \mathbf{PNLT}_{\mathtt{MAX}}$  data in the literature.'

Given the computed  $\mathbf{L}_{\overline{\text{MM}}}$  PNIIT<sub>MAX</sub> and the user-defined duration and location for a **runup**, the **SEL/EPNL** for the **runup** is computed by multiplying the acoustic energy associated with the  $\mathbf{L}_{\overline{\text{MM}}}$  PNIIT<sub>MAX</sub> by the user-defined duration, and converting the total **runup** energy to a decibel value as follows:

$$SEL_{presump} = 10log_{10} \left( \frac{DURR}{Dexp(LL_{MA}/LD)} \right) \text{ and}$$
 (3)

directivity pattern discussed in Appendix A is a reasonable approximation of runup directivity.

# C.2 References

- Bishop, **D.E.**, Beckman, **J.M.**, **Bucka**, **M.P.**, Revision of Civil Aircraft Noise Data for the **Integrated** Noise Model (**INM**), Report No. **6039**, Project No. **04453**, **Canoga** Park, CA: **BBN** Laboratories Incorporated, September **1986**..
- A320 Noise Definition Manual NDM, FRANCE: Airbuss Industriæ, 1990.
- An Excerpt from the Model **B747** Flight Manual, **A-Weighted**Noise Level Contours, Seattle, WA: Boeing Commercial
  Airplane Company, **1986**..

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- Bishop, **D.E.**, Beckman, **J.M.**, **Bucka**, **M.P.**, Revision of Civil Aircraft Noise Data for the **Integrated** Noise Model (**INM**), Report No. **6039**, Project No. **04453**, **Canoga** Park, CA: **BBN** Laboratories Incorporated, September **1986**..
- A320 Noise Definition Manual NDM, FRANCE: Airbuss Industriæ, 1990.
- An Excerpt from the Model **B747** Flight Manual, **A-Weighted**Noise Level Contours, Seattle, WA: Boeing Commercial
  Airplane Company, **1986**..

directivity pattern discussed in Appendix A is a reasonable approximation of runup directivity.

# C.2 References

- Bishop, **D.E.**, Beckman, **J.M.**, **Bucka**, **M.P.**, Revision of Civil Aircraft Noise Data for the **Integrated** Noise Model (**INM**), Report No. **6039**, Project No. **04453**, **Canoga** Park, CA: **BBN** Laboratories Incorporated, September **1986**..
- A320 Noise Definition Manual NDM, FRANCE: Airbuss Industriæ, 1990.
- An Excerpt from the Model **B747** Flight Manual, **A-Weighted**Noise Level Contours, Seattle, WA: Boeing Commercial
  Airplane Company, **1986**..

COMMENTS:

SETUP:

TITLE <ANNUAL AVERAGE EXPOSURE AT AN EXAMPLE OF A MEDIUM HUB AIRPORT> AIRPORT <EXAMPLE MHA>

ALTITUDE 0

TEMPERATURE 59 F

RUNWAYS

RW 09L-27R RW 27L-09R RW 35-17 TO 9487 -497 HEADING=993 4203 7355 -1410 TO -6920 TO 6407 -1044HEADING=22/7/2 1366 DT 100 TO

AIRCRAFT:

TYPES

AC 747200

AC DC1030

AC DC870

AC **A300**AC **757PW**AC **727015** 

AC DC930 AC MD81

AC 737300

AC SABRIBO AC BECSISIP

CURVE=250C30 PARAM=HELII STAGE 1=HORFLIT AC S-76 CATEGORY=PGA

NOISE CURVES

NC 250C30 3 BY 8 3 BY 8 EPNL THRUSTS 200 91.2 97.2 90.2 400 85.8 87.2 83.1 79.4 84.5 80.7 600 90.6 87.4 1000 2000 73.7 75.1 82.6 67.6 63.1 68.2 63.8 77.2 73.7 4000 6000 10000 SEL THRUSTS 88.6 84.2 81.5 200 90.0 95.6 85.6 82.9 91.5 89.0 400 600 77.8 72.1 66.0 1000 81.0 75.6 2000 73.5 4000 66.6 6000 61.5 62.2 72.1 10000 55.2 55.8 67.1

APPROACH PARAMETERS

WEIGHT=10000 ENGINE=2 STOP=1 AP HELI FINSP=1600 TAXI=1600

LNDFES-33

INT..NM

PROFILES APPROACH

PF ALT3D SEGMENTS=7

20. 10. 5. 3. 1. -.12 20. 6000 3236 1644 1007 370 0 0 0 ERMSP INTSP APPSP FINSP LNDSP REVSP TAXI DISTANCES ALTITUDES TERMSP SPEEDS INTFIS APPFAS LNDFFS LNDFLS THRUSTS

PF COPTR SEGMENTS=7

3.9 0.8 0 DISTANCES 1500 1000 500 0 0 FINSP FINSP FINSP TAXI ALTITUDES 2000 SPEEDS FINSP FINSP FINSP FINSP FINSP FINSP THRUSTS LNDFFS LNDFFS LNDFFS LNDFFS LNDFFS LNDFFS

ECHO.

PROFILES TAKEOFF

PF HORFLT SEGMENTS-88 WEIGHT-100000 ENGINES-22 DISTANCES 4126 6876 687777 9626 100000 15000 1376 ALTITUDES 0 500 1000 1000 1500 1500 1500 SPEEDS 32 160 160 160 160 160 160 160 THRUSTS

Note: Standard conditions have been defined. To implement the takeoff profile generator Section 2.1. In addition, the elevationeRhancementhas midt-been Bedecded. To implement elevation see Section 2.2.

Note: A runway touch-down point of 1054 ft has been defined for approach operations on Runway 35 (i.e., 100 ft for theusex-defined DT plus 354 ft for the fixed touch-down point).

```
TRACK TR1 RWY 09L STRAIGHT 4.1 LEFT 5 H 1.6 STRAIGHT 50

OPER 747200 RUNUUP 1 D=10 STAGE 1 D=1.1 STAGE 2 D=1.1 STAGE 3 D=1.1

OPER DC1030 STAGE 1 D=1.5 STAGE 2 D=2.5 STAGE 4 D=2

OPER 757PW STAGE 2 D=1.5

OPER 727015 STAGE 1 D=3 N=.5 STAGE 2 D=2.6 N=.6

STAGE 3 D=1.2 N=.1

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5

STAGE 3 D=1.2 N=.1

OPER MD81 STAGE 2 D=1.0

OPER 737300 STAGE 1 D=1.5 N=.5
    TRACK TR2 RWY 27R STRAIGHT 4.1 LEFT 88 D 1.6 STRAIGHT 50

OPER DC1030 STAGE 1 De1.5 STAGE 2 D=3 STAGE 3 D=1

STAGE 4 D=1 STAGE 5 D=.5 STAGE 6 D=.5
        OPER DC870
                              STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1
                              STAGE 3 D=1 STAGE 4 D=2.5 STAGE 5 D=1
        STAGE 6 D=.5

OPER A300 STAGE 2 D=2 STAGE 3 D=1

OPER 727015 STAGE 1 D=6 N=1 STAGE 2 D=4.4 N=1.4 STAGE 3 D=1.8
                                            N=.4
    TRACK TR3 RWY 09R STRAIGHT 1.3 LEFT 15 D 1.0 STRAIGHT 1.4
RIGHT 57 D 1.8 STRAIGHT .5 RIGHT 50 D 1.6
STRAIGHT 50

OPER DC8700 STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1 STAGE 3 D=1
STAGE 4 D=1.5 STAGE 5 D=.5

OPER 757PW STAGE 3 D=2.5
        OPER 727015 STAGE 1 D=21 N=2.5 STAGE 2 D=16.5 N=4
        STAGE 3 D=8 N=.5

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5 STAGE 3 D=1.5

OPER MD81 STAGE 1 D= 3 N=.5
        OPER 7373000 STAGE 2 D=.5
    TRACK TR4 RWY 27R STRAIGHT 4.1 LEFT 230 H 2.2 STRAIGHT 50
       OPER SABREO STAGE 1 D=3 N=.1
    TRACK TR5 RWY 35 STRAIGHT 50
       OPER SABRESO STAGE 1 D=30.5 N=2.5
OPER BECSSP STAGE 1 D=13 N=1
    TRACK TR6 RWY 17 STRAIGHT 50
OPER SABRRED STAGE 1 D=12.5 N=.5
OPER BEC58P STAGE 1 D=30 N=3
   TRACK TR7 RWY 17 STRAIGHT 1.5 RIGHT 265 H .25 STRAIGHT 3 LEFT 245 H 1.0 STRAIGHT 50 OPER S-76 STAGE 1 D=5
LANDINGS BY PERCENTAGE:
       OPER 747200 PROF=SIDEED D=3 N=0 OPER DC1030 PROF=SIDEED D=22 N=2
       OPER DC8700 PROF=ALTED D=22 N=2
       OPER DC870 PROF-MININ D=22 N=2
OPER 757PW PROF-SIDBAD D=2 N=1
OPER 727Q15 PROF-SIDBAD D=6 N=1
OPER DC930 PROF-MININ D=70 N=10
OPER MD81 PROF-SIDBAD D=1.5 N=.5
OPER 737300 PROF-SIDBAD D=1.5 N=.5
       OPER SABREO PROF-SMD3D D=25 N=2
OPER BEC58P PROF-SMD5D D=42 N=5
                             PROF=COPTR D=5
       OPER S-76
   TRACK TR8 RWY 27R STRAIGHT 50 RIGHT 82 D 1.5 STRAIGHT 4.2 PERCENT COM=772 GA=0
    TRACK TR9 RWY 09R HEADING 260 STRAIGHT 50 RIGHT 272 H 1.5
                                     STRAIGHT 7 PERCENT COM=28 GA=0
   TRACK TRIO RWY 35 STRAIGHT 50 PERCENT COM=0 GA=30
   TRACK TR11 RWY 17 STRAIGHT 50 PERCENT COM=0 GA=70
TOUCHNGOS BY FREQUENCY:
   TRACK TR14 RWY 17 STRAIGHT 3 LEFT 180 D 2.0 STRAIGHT 6
       LEFT 180 D 2.0 STRAIGHT 3 OPER BEC58P STAGE 1 PROF STD5D D=23
```

Note: A runup operation has been defined for the B747-200 airplane. The runup takes place at the start of Runway 091 and lasts for 10 seconds, (i.e., in terms of average yearly duration).

```
TRACK TRI RWY 09L STRAIGHT 4.1 LEFT 5 H 1.6 STRAIGHT 50

OPER 747200 RUNUUP 1 D=10 STAGE 1 D=1.1 STAGE 2 D=1.1 STAGE 3 D=1.1

OPER DC1030 STAGE 1 D=1.5 STAGE 2 D=2.5 STAGE 4 D=2

OPER 757PW STAGE 2 D=1.5

OPER 727015 STAGE 1 D=3 N=.5 STAGE 2 D=2.6 N=.6

STAGE 3 D=1.2 N=.1

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5

STAGE 3 D=1.5

OPER MD81 STAGE 2 D=1.0

OPER 737300 STAGE 1 D=1.5 N=.5
    TRACK TR2 RWY 27R STRAIGHT 4.1 LEFT 88 D 1.6 STRAIGHT 50

OPER DC1030 STAGE 1 De1.5 STAGE 2 D=3 STAGE 3 D=1

STAGE 4 D=1 STAGE 5 D=.5 STAGE 6 D=.5
        OPER DC870
                               STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1
                                STAGE 3 D=1 STAGE 4 D=2.5 STAGE 5 D=1
        STAGE 6 D=.5

OPER A300 STAGE 2 D=2 STAGE 3 D=1

OPER 727015 STAGE 1 D=6 N=1 STAGE 2 D=4.4 N=1.4 STAGE 3 D=1.8
                                               N=.4
    TRACK TR3 RWY 09R STRAIGHT 1.3 LEFT 15 D 1.0 STRAIGHT 1.4
RIGHT 57 D 1.8 STRAIGHT .5 RIGHT 50 D 1.6
STRAIGHT 50

OPER DC8700 STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1 STAGE 3 D=1
STAGE 4 D=1.5 STAGE 5 D=.5

OPER 757PW STAGE 3 D=2.5
        OPER 727015 STAGE 1 D=21 N=2.5 STAGE 2 D=16.5 N=4
        STAGE 3 D=8 N=.5

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5 STAGE 3 D=1.5

OPER MD81 STAGE 1 D= 3 N=.5
        OPER 737300 STAGE 2 D=.5
    TRACK TR4 RWY 27R STRAIGHT 4.1 LEFT 230 H 2.2 STRAIGHT 50
        OPER SABREO STAGE 1 D=3 N=.1
    TRACK TR5 RWY 35 STRAIGHT 50
        OPER SABRESO STAGE 1 D=30.5 N=2.5
OPER BECSSP STAGE 1 D=13 N=1
    TRACK TR6 RWY 17 STRAIGHT 50
OPER SABRRED STAGE 1 D=12.5 N=.5
OPER BEC58P STAGE 1 D=30 N=3
    TRACK TR7 RWY 17 STRAIGHT 1.5 RIGHT 265 H .25 STRAIGHT 3 LEFT 245 H 1.0 STRAIGHT 50 OPER S-76 STAGE 1 D=5
LANDINGS BY PERCENTAGE:

        OPER 747200
        PROF=SIDED
        D=3 N=0

        OPER DC1030
        PROF=SIDED
        D=22 N=2

        OPER DC870
        PROF=ANTISED
        D=22 N=2

       OPER A300 PROF=SIDED D=2 N=1

OPER 757PW PROF=SIDED D=6 N=1

OPER 727Q15 PROF=SIDED D=70 N=10

OPER MD81 PROF=SIDED D=4 N=.5

OPER 737300 PROF=SIDED D=1.5 N=.5
       OPER SABREO PROF-SMDRD D=25 N=2
OPER BEC58P PROF-SMDSD D=42 N=5
                              PROF=COPTR D=5
        OPER S-76
    TRACK TR8 RWY 27R STRAIGHT 50 RIGHT 82 D 1.5 STRAIGHT 4.2
PERCENT COM=772 GA=0
    TRACK TR9 RWY 09R HEADING 260 STRAIGHT 50 RIGHT 272 H 1.5
                                       STRAIGHT 7 PERCENT COM=28 GA=0
    TRACK TRIO RWY 35 STRAIGHT 50 PERCENT COM=0 GA=30
    TRACK TR11 RWY 17 STRAIGHT 50 PERCENT COM=0 GA=70
TOUCHNEOS BY FREQUENCY:
    TRACK TR14 RWY 17 STRAIGHT 3 LEFT 180 D 2.0 STRAIGHT 6
       LEFT 180 D 2.0 STRAIGHT 3 OPER BEC58P STAGE 1 PROF STD5D D=23
```

Note: A runup operation has been defined for the B747-200 airplane. The runup takes place at the start of Runway 091 and lasts for 10 seconds, (i.e., in terms of average yearly duration).

```
TRACK TRI RWY 09L STRAIGHT 4.1 LEFT 5 H 1.6 STRAIGHT 50

OPER 747200 RUNOUP 1 D=10 STAGE 1 D=1.1 STAGE 2 D=1.1 STAGE 3 D=1.1

OPER DC1030 STAGE 1 D=1.5 STAGE 2 D=2.5 STAGE 4 D=2

OPER 757PW STAGE 2 D=1.5

OPER 727015 STAGE 1 D=3 N=.5 STAGE 2 D=2.6 N=.6

STAGE 3 D=1.2 N=.1

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5
        STAGE 3 D=1.5

OPER MD81 STAGE 2 D=1.0

OPER 737300 STAGE 1 D=2.5 N=.5
    TRACK TR2 RWY 27R STRAIGHT 4.1 LEFT 88 D 1.6 STRAIGHT 50

OPER DC1030 STAGE 1 De1.5 STAGE 2 D=3 STAGE 3 D=1

STAGE 4 D=1 STAGE 5 D=.5 STAGE 6 D=.5
        OPER DC870
                               STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1
                               STAGE 3 D=1 STAGE 4 D=2.5 STAGE 5 D=1
        STAGE 6 D=.5

OPER A300 STAGE 2 D=2 STAGE 3 D=1

OPER 727015 STAGE 1 D=6 N=1 STAGE 2 D=4.4 N=1.4 STAGE 3 D=1.8
                                              N=.4
    TRACK TR3 RWY 09R STRAIGHT 1.3 LEFT 15 D 1.0 STRAIGHT 1.4
RIGHT 57 D 1.8 STRAIGHT .5 RIGHT 50 D 1.6
STRAIGHT 50

OPER DC8700 STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1 STAGE 3 D=1
STAGE 4 D=1.5 STAGE 5 D=.5

OPER 757PW STAGE 3 D=2.5
        OPER 727015 STAGE 1 D=21 N=2.5 STAGE 2 D=16.5 N=4
        STAGE 3 D=8 N=.5

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5 STAGE 3 D=1.5

OPER MD81 STAGE 1 D= 3 N=.5
        OPER 737300 STAGE 2 D=.5
    TRACK TR4 RWY 27R STRAIGHT 4.1 LEFT 230 H 2.2 STRAIGHT 50
       OPER SABREO STAGE 1 D=3 N=.1
    TRACK TR5 RWY 35 STRAIGHT 50
       OPER SABRESO STAGE 1 D=30.5 N=2.5
OPER BECSSP STAGE 1 D=13 N=1
    TRACK TR6 RWY 17 STRAIGHT 50
OPER SABRRED STAGE 1 D=12.5 N=.5
OPER BEC58P STAGE 1 D=30 N=3
   TRACK TR7 RWY 17 STRAIGHT 1.5 RIGHT 265 H .25 STRAIGHT 3 LEFT 245 H 1.0 STRAIGHT 50 OPER S-76 STAGE 1 D=5
LANDINGS BY PERCENTAGE:

        OPER 747200
        PROF=SIDED
        D=3 N=0

        OPER DC1030
        PROF=SIDED
        D=22 N=2

        OPER DC870
        PROF=ANTISED
        D=22 N=2

       OPER A300 PROF=SIDED D=2 N=1

OPER 757PW PROF=SIDED D=6 N=1

OPER 727Q15 PROF=SIDED D=70 N=10

OPER MD81 PROF=SIDED D=4 N=.5

OPER 737300 PROF=SIDED D=1.5 N=.5
       OPER SABREO PROF-SMDRD D=25 N=2
OPER BEC58P PROF-SMDSD D=42 N=5
                             PROF=COPTR D=5
       OPER S-76
   TRACK TR8 RWY 27R STRAIGHT 50 RIGHT 82 D 1.5 STRAIGHT 4.2
PERCENT COM=772 GA=0
    TRACK TR9 RWY 09R HEADING 260 STRAIGHT 50 RIGHT 272 H 1.5
                                      STRAIGHT 7 PERCENT COM=28 GA=0
   TRACK TRIO RWY 35 STRAIGHT 50 PERCENT COM=0 GA=30
   TRACK TR11 RWY 17 STRAIGHT 50 PERCENT COM=0 GA=70
TOUCHNEOS BY FREQUENCY:
   TRACK TR14 RWY 17 STRAIGHT 3 LEFT 180 D 2.0 STRAIGHT 6
       LEFT 180 D 2.0 STRAIGHT 3 OPER BEC58P STAGE 1 PROF STD5D D=23
```

Note: A runum operation has been defined for the B747-2000 airplane. The runum takes place at the start of Runway 091 and lasts for 10 seconds, (i.e., in terms of average yearly duration).

```
TRACK TRI RWY 09L STRAIGHT 4.1 LEFT 5 H 1.6 STRAIGHT 50

OPER 7472000 RUNNUP 1 D=100 STAGE 1 D=1.1 STAGE 2 D=1.1 STAGE 3 D=1.1

OPER DC10300 STAGE 1 D=1.5 STAGE 2 D=2.5 STAGE 4 D=2

OPER 757PW STAGE 2 D=1.5

OPER 727015 STAGE 1 D=3 N=.5 STAGE 2 D=2.6 N=.6

STAGE 3 D=1.2 N=.1

OPER DC0200 STAGE 1 D=25 K N=.5 STAGE 2 D=2 N=.5
        OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5
        STAGE 3 D=1.5

OPER MD81 STAGE 2 D=1.0

OPER 737300 STAGE 1 D=2.5 N=.5
    TRACK TR2 RWY 27R STRAIGHT 4.1 LEFT 88 D 1.6 STRAIGHT 50

OPER DC1030 STAGE 1 De1.5 STAGE 2 D=3 STAGE 3 D=1

STAGE 4 D=1 STAGE 5 D=.5 STAGE 6 D=.5
        OPER DC870
                              STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1
                              STAGE 3 D=1 STAGE 4 D=2.5 STAGE 5 D=1
        STAGE 6 D=.5

OPER A300 STAGE 2 D=2 STAGE 3 D=1

OPER 727015 STAGE 1 D=6 N=1 STAGE 2 D=4.4 N=1.4 STAGE 3 D=1.8
                                             N=.4
    TRACK TR3 RWY 09R STRAIGHT 1.3 LEFT 15 D 1.0 STRAIGHT 1.4
RIGHT 57 D 1.8 STRAIGHT .5 RIGHT 50 D 1.6
STRAIGHT 50

OPER DC8700 STAGE 1 D=2 N=.5 STAGE 2 D=3.5 N=1 STAGE 3 D=1
STAGE 4 D=1.5 STAGE 5 D=.5

OPER 757PW STAGE 3 D=2.5
        OPER 727015 STAGE 1 D=21 N=2.5 STAGE 2 D=16.5 N=4
        STAGE 3 D=8 N=.5

OPER DC930 STAGE 1 D=26.5 N=.5 STAGE 2 D=8 N=.5 STAGE 3 D=1.5

OPER MD81 STAGE 1 D= 3 N=.5
        OPER 737300 STAGE 2 D=.5
    TRACK TR4 RWY 27R STRAIGHT 4.1 LEFT 230 H 2.2 STRAIGHT 50
       OPER SABREO STAGE 1 D=3 N=.1
    TRACK TR5 RWY 35 STRAIGHT 50
       OPER SABRESO STAGE 1 D=30.5 N=2.5
OPER BECSSP STAGE 1 D=13 N=1
    TRACK TR6 RWY 17 STRAIGHT 50
OPER SABRRED STAGE 1 D=12.5 N=.5
OPER BEC58P STAGE 1 D=30 N=3
   TRACK TR7 RWY 17 STRAIGHT 1.5 RIGHT 265 H .25 STRAIGHT 3 LEFT 245 H 1.0 STRAIGHT 50 OPER S-76 STAGE 1 D=5
LANDINGS BY PERCENTAGE:

        OPER 747200
        PROF=SIDED
        D=3 N=0

        OPER DC1030
        PROF=SIDED
        D=22 N=2

        OPER DC870
        PROF=ANTISED
        D=22 N=2

       OPER A300 PROF=SIDED D=2 N=1

OPER 757PW PROF=SIDED D=6 N=1

OPER 727Q15 PROF=SIDED D=70 N=10

OPER MD81 PROF=SIDED D=4 N=.5

OPER 737300 PROF=SIDED D=1.5 N=.5
       OPER SABREO PROF-SMDRD D=25 N=2
OPER BEC58P PROF-SMDSD D=42 N=5
                             PROF=COPTR D=5
       OPER S-76
   TRACK TR8 RWY 27R STRAIGHT 50 RIGHT 82 D 1.5 STRAIGHT 4.2
PERCENT COM=772 GA=0
    TRACK TR9 RWY 09R HEADING 260 STRAIGHT 50 RIGHT 272 H 1.5
                                      STRAIGHT 7 PERCENT COM=28 GA=0
   TRACK TRIO RWY 35 STRAIGHT 50 PERCENT COM=0 GA=30
   TRACK TR11 RWY 17 STRAIGHT 50 PERCENT COM=0 GA=70
TOUCHNEOS BY FREQUENCY:
   TRACK TR14 RWY 17 STRAIGHT 3 LEFT 180 D 2.0 STRAIGHT 6
       LEFT 180 D 2.0 STRAIGHT 3 OPER BEC58P STAGE 1 PROF STD5D D=23
```

Note: A runup operation has been defined for the B747-2000 airplane. The runup takes place at the start of Runway 091 and lasts for 10 seconds, (i.e., in terms of average yearly duration).

# **1.0** INTRODUCTION

This User Guide is a combined tutorial-manual that comes to you as part of **WINM 4.11.** 

# **2.0** OPERATIONAL REQUIREMENTS

# Software/Hardware Requirements

**WINM** has the same **software** and hardware requirements as Microsoft Windows 3.x.

# 3.0 INSTALLATION

Before you start, make sure that you have **all** the material supplied with **WINM 4.11** and check that your equipment matches the list in Chapter **2**.

### **Installation Procedure**

**WINM** comes with four files under the directory **INM** 11. These files will be installed as part of the primary **INM** installation. They are:

WINMIEXE

 The window plot program for INM

 INMINPUT.TST

 Test case version of input data
 Test case version of contour data

 INMCOLOR DATA - Color control file

### Windows Installation of **WINM**

- Start up Windows by typing WIN.
- Open Windows' Program Manager.
- Open the Windows **File** menu. Select **New**.
- The New *Program Object* dialog box will appear.
- Select **Program Group** and click on **OK**.
- The **Program Group Properties** dialog box will appear.
- Type **WINM** in the *Description* field. Click on OK.
- Open the Windows **Eile** menu. Select **Brew**.
- The *New Program Object* dialog box will appear.
- Select *Program Item* and click on OK.

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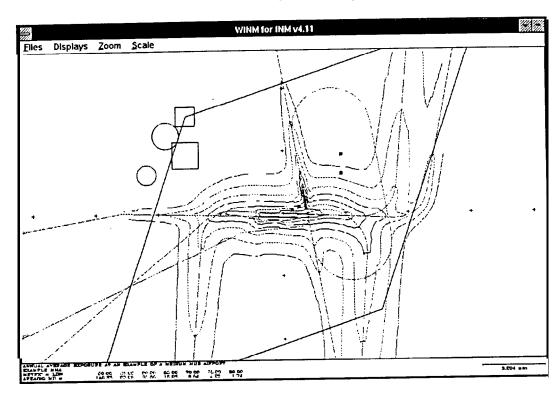
# 4.0 TUTORIAL

# **About the Tutorial**

The tutorial has been structured so that the exercises will give you progressive familiarity with the operations that you will carry out within **WINM 4.11**.

# **4.1** Loading **INM** Files

The starting point for this exercise is the default screen you see as soon as you start **WINM 4.111** from the Windows *Program Manager*.



By default, **WINM** uses two default **INM** input files. To load a different set of input files,

- . Place the mouse pointer arrow on **Files** in the menu bar; and
- . Click once on the left mouse button.
- . In the menu, click the mouse pointer on **Load**.

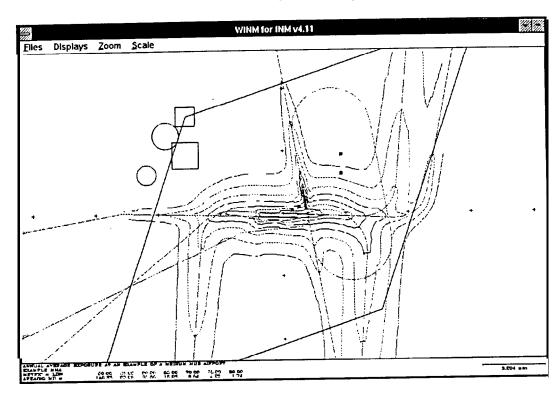
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# **About the Displays Dialog Box**

This menu option allows the user to select which data display information is to be shown. Select any option one at a time and click on Apply to see its effect immediately. Experiment with as many combinations as you like. Text labels may be independently selected for each displayed item type by clicking on the *Label* box next to each item.

# **4.2.1** Runways

This radio button turns on/off the display of the runways.

# **4.2.2** Flight Tracks

This radio button turns on/off the display of the flight tracks.

### **4.2.3** Noise Contours

This radio button turns on/off the display of the noise contours.

# **4.2.4** Fill Contours

This radio button turns on/off the option to fill the contours.

## **4.2.5** Noise Sensitive Area

Although every one of these options depends on the **INM** input files selected, the *Noise Sensitive Area* is a special option. This menu option displays user-defined sensitive noise areas. These areas are defined after the END statement of the **INM** input data file **(FOR03.DAT)**, and each can be either a polygon, square, circle, or point. The area can be defined in NM or FEET and a descriptive text label for label description of the area can be inserted after an asterisk (\*) at the end of the line. The user can input/modify these data before or after running the noise model (but not during running the **WINM** program). The following shows an example of the descriptive text labels as seen in the default **INM** input filename **timminput.TSIP**::

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# 4.3 Z o o m

## **About the Zoom Menu**

**WINM 4.11** offers you the capabilities to zoom in/out of various sections of the display for specialize viewing.

We will now become familiarized with the zooming capabilities within **WINM 4.11.** 

- Place the mouse pointer arrow on **Zoom** in the menu bar; and
- . Click once on the left mouse button.

You will see the drop-down **Zoom** menu appear.

• In the menu, click the mouse pointer on **Zoom In.** 

A zoom box will appear in the center of the screen,

- Move the mouse to expand/shrink the zoom box.
- If you desire to move the zoom area, hold down the right button and drag the zoom box to a different area.
- Click the left button to accept zoom.

Note! At any time, click the right button to cancel the zoom box.

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You will see the drop-down Scale menu appear.

• In the menu, click the mouse pointer on any of the menu selections to see its effect to the scale shown at the bottom right-hand comer.

We have now covered the major capabilities of **WINM 4.11**.

Let's print the display to a printer.

- Place the mouse pointer arrow on **Files** in the menu bar; and
- Click once on the left mouse button.

You will see the drop-down **Files** menu appear.

• In the menu, click the mouse pointer on *Print*. A submenu will appear.

### 4.5 Print

# **About the Print Menu Option**

This menu option allows a hard copy output to a printer. The printout will go to the default printer which can be set via **Printers** in **Control Panel.** 

#### Actual Scale

This menu option allows the user to print the current screen for scaling. The scale unit will reflect 1 inch on the hardcopy printout.

#### Screen Zoom

This menu option allows the user to print the current screen at the current zoom factor. The **left** and right edges of the hardcopy printout will be set to match the left and right edges of the screen display. If the printer's page orientation is set to 'Landscape' in the Windows *Print Manager*, then the top and bottom edges of the hardcopy printout will be set to match the top and bottom edges of the screen display as well.

To print what is displayed, select Screen Zoom

You can now exit the program.

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# **6.0** Program Limitation.

- Maximum 2000 points per noise contour.
- Runways information input is in FEET (from **INM** input file).
- Tracks information input is in NM (from **INM** input file).
- Shade pattern on hard copy may not be the same as on the screen due to the incompatibility number of colors support by the display and the printer.

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#### DOT/FAA/EE/93-03 DOT-VNTSC-FAA-93-19

Office of Environment and Energy Washington, DC **20591** 

# **INM**

# Integrated Noise Model Version 4.1111

# User's Guide - Supplement

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Supplement to

Report No. DOT/FAA/EE/92/022

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US. Department of Transportation Federal Aviation Administration